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Physics Abstracts

CONTENTS

	PAGE
MATHEMATICS	—
ASTRONOMY. ASTROPHYSICS GEODESY	—
PHYSICS	823
Fundamentals	823
General mechanics. Mechanics of solids	826
Mechanical measurements	827
Mechanics of fluids	827
Capillarity	—
Molecular theory of liquids	827
Mechanics of gases	828
Molecular theory of gases	829
Vibrations. Acoustics	829
Optics. Radiation. Spectra	830
Heat	836
Thermodynamics	838
Electricity	838
Electrostatics. Dielectrics	838
Electric conduction. Currents	840
Electric discharges	844
X-rays	845
Cathode rays. Positive rays	846
Discharge tubes. Counters	847
Ionization. Thermionics	847
Cosmic rays	848
Magnetism	848
Electromagnetism. Electrodynamics	850
Electromagnetic waves and oscillators	850
Molecular and atomic structure	851
Theory of solid state	851
Molecules	852
Atoms. Nucleus. Isotopes	853
Radioactivity. α-, β- and γ-rays	856
Nuclear reactions	858
Atom and molecular beams. Mesons. Neutrons	860
Structure of solids	862
Elasticity. Strength. Rheology	863
PHYSICAL CHEMISTRY	863
Phase equilibrium. Chemical reactions	863
Electrochemistry	—
Photochemistry. Radiation chemistry	864
Dispersions. Colloids. Adsorption	—
Chemical structure	—
Chemical analysis	—
CRYSTALLOGRAPHY	864
Atomic and X-ray crystallography	864
GEOPHYSICS	866
Atmosphere. Meteorology	866
BIOLOGY	867
Medical science. Human physiology	867
TECHNIQUE. MATERIALS	868
Photography	868

The number printed above each abstract on the right is the Universal Decimal subject classification number; the abstracts are arranged in order of these numbers throughout each issue.

The monthly Author Index, List of Journals, Errata and Notes follow immediately after the last page of abstracts.

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PHYSICS ABSTRACTS

Volume 60 NOVEMBER 1957 Number 719

PHYSICS 53

FUNDAMENTALS 530.1

530.12

8972. A GENERAL SCHEMA FOR RELATIVISTIC PHYSICS. J.M.Souriau.
C.R. Acad. Sci. (Paris), Vol. 244, No. 23, 2779-81 (June 3, 1957). In French.

An outline is given of a variational system involving variables of state. The system includes classical relativity theory, but is capable of various generalizations. R.A.Newing

530.12

8973. ON UNIFORM ACCELERATION IN SPECIAL AND GENERAL RELATIVITY. L.Marder.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 1, 194-8 (Jan., 1957).

Various definitions of uniform acceleration are possible in relativity theory. Two of these are considered with particular reference to their physical realizations. A.

530.12

8974. ON THE LAGRANGIAN IN SPECIAL RELATIVITY THEORY. L.Infeld.
Bull. Acad. Polon. Sci. Cl.3, Vol. 5, No. 5, 491-5 (1957).

The Lagrangian formulation of special relativistic mechanics as discussed by Szamosi (Abstr. 3935/1957) is developed in a more general way and is applied to the motion of a particle in a potential field $\phi = -g^2/r$ and in a given electromagnetic field.

G.Stephenson

530.12

8975. USE OF THE LORENTZ TRANSFORMATION FOR RELATIVE VELOCITIES GREATER THAN c. H.Arzeliès.
C.R. Acad. Sci. (Paris), Vol. 244, No. 22, 2698-700 (May 27, 1957). In French.

An attempt is made in the author's "Relativistic kinematics" (Gauthier-Villars, 1955) to interpret the Lorentz transformations in the case of velocities exceeding that of light. An attempt is now made to associate such velocities with the idea of anti-particles.

R.A.Newing

530.12

8976. FURTHER CONSIDERATIONS CONCERNING THE PHYSICAL INTERPRETATION OF THE LORENTZ TRANSFORMATIONS. L.Yanoshi (Jánossy).
Uspekhi fiz. Nauk, Vol. 62, No. 1, 149-82 (1957). In Russian.

The author reconsiders the material of an earlier paper (Abstr. 2173/1953) dealing with some aspects in greater detail, e.g. the dynamics of a rigid body and what happens when the system is accelerated. The basic experimental facts are reviewed and considered from the points of view of Lorentz, Fitzgerald and Einstein. The dynamics of a physical system undergoing acceleration, Lorentz deformation in an arbitrary dynamical system and finally covariant Lorentz forces and the behaviour of a mechanical system are discussed. C.R.S.Manders

530.12

8977. ON THE PAPER OF L.YANOSHI (JÁNOSSY) "FURTHER CONSIDERATIONS CONCERNING THE PHYSICAL INTERPRETATION OF THE LORENTZ TRANSFORMATIONS". I.E.Tamm.
Uspekhi fiz. Nauk, Vol. 62, No. 1, 183-5 (1957). In Russian.

Jánossy is criticized for a sceptical attitude towards the theory of relativity which, it is asserted, leads him to make a number of incorrect statements. Two of these are examined at length. The author concludes that Jánossy's paper does nothing at all to facilitate a physical interpretation of the Lorentz transformations.

C.R.S.Manders

530.12

8978. TWO-COMPONENT SPINORS IN GENERAL RELATIVITY. P.G.Bergmann.
Phys. Rev., Vol. 107, No. 2, 624-9 (July 15, 1957).

A general-relativistic theory of two-component spinors is developed somewhat along the lines pioneered more than twenty years ago by Weyl and by Infeld and van der Waerden. This formalism is in some respects more natural than the theory of four-component spinors. Beginning by introducing into a four-dimensional manifold as the basic geometric structure a set of four 2 x 2 Hermitian matrices, σ^μ, it is shown that these matrices by themselves define uniquely a Riemannian metric with the usual signature of a space-time manifold. It turns out that one can describe the gravitational field and its laws very conveniently in this matrix formalism; at the same time the σ^μ enable one to construct invariant two-component and four-component spinor wave-equations. These formal possibilities are used to define local Lorentz transformations and, in particular, the transformations corresponding to time reversal and to space inversion. A.

530.12

8979. ELECTRIC FORCE AND THE DEFINITION OF CHARGE CURRENT IN [EINSTEIN'S] UNIFIED THEORY. H.Treder.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 369-80 (1956). In German.

The first-order field equations for weak fields allow two alternative definitions of charge current corresponding to the 4-current density definitions introduced by Einstein (1956) and by Einstein and Straus (1946). A static spherically symmetric solution of the field equations is obtained in the first approximation in the form $\phi = (a/r) + cr$, where the physical significance of the constants a and c depends on the definition of charge current adopted. With the first definition, c = 0 and the force between two slowly moving point charges is found to be zero in agreement with Infeld (1950) and Callaway (1953); for the second definition, 2c is interpreted as the electric charge, and in this case there is a Coulomb force together with a uniform radial force between the two charges.

R.A.Newing

530.12

8980. BIANCHI IDENTITIES AND CONSERVATION IDENTITIES IN THE EINSTEIN–SCHRÖDINGER UNIFIED THEORY. S.Mavrides.
C.R. Acad. Sci. (Paris), Vol. 244, No. 20, 2482-4 (May 13, 1957). In French.

530.12

8981. ON ISOTROPIC GEODESICS IN THE JORDAN--THIRY [UNIFIED] THEORY. L.Bel.
C.R. Acad. Sci. (Paris), Vol. 244, No. 26, 3129-31 (June 24, 1957). In French.

530.12

8982. A VARIATION PRINCIPLE FOR CLASSICAL FIELD THEORIES. J.Pachner.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 353-68 (1956). In German.

The action function is expressed in the form $W = W_1 + W_2$, where W_1 is associated with vacuum fields external to elementary particles and W_2 depends on certain integral properties of the particles such as invariant mass and charge. In evaluating δW_1, it is assumed that variations vanish on the boundaries of the space–time region considered, but not on the walls of the world-tubes of the particles. The variation principle $\delta W = 0$ then gives the vacuum field equations together with a set of relations which give integration constants in terms of particle parameters. With a suitable choice of action density in W_1 and with suitable assumptions concerning W_2, the new principle provides a unified theory corresponding to that of Einstein–Schrödinger. R.A.Newing

530.145

8983. ON THE SYMMETRY BETWEEN SPACE AND TIME REVERSAL IN SPINOR FORMALISM. P.Merat.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3036-8 (June 17, 1957). In French.

If one introduces a complete symmetry between space and time reversal one arrives, in spinor formalism, at a correspondence between space–time and four two-dimensional spinor spaces, thus doubling the usual number of spinor spaces. L.Pincherle

530.145 : 531.51 : 535.13

8984. DISCONTINUITIES OF FIELD DERIVATIVES AND RADIATION IN COVARIANT THEORIES. A.Trautman.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 3, 273-7 (1957).

The possible forms of discontinuities of field derivatives and their connection with the problems of radiation and "geometrical optics" are investigated for general fields and applied to the electromagnetic and gravitational fields. W.A.Hepner

530.145

8985. SOME REMARKS ON NON-LOCAL THEORIES. J.Rzewuski.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 4, 393-400 (1957).

Using the example of two scalar bi-local fields, one real and one complex, with non-local interaction, it is shown that, under certain conditions on the two mass operators, the system can be described by equations for local fields with non-local interaction. The particular models proposed by Yukawa (Abstr. 7448/1953) and by Markov (Abstr. 97/1957) are discussed as special cases of these equations and some consequences for the form-factors and the models of elementary particles are pointed out. W.A.Hepner

530.145

8986. CAUSAL PRODUCTS IN QUANTUM FIELD THEORY. J.C.Polkinghorne.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 1, 261-2 (Jan., 1957).

A new type of product of field operators is considered and the equations that it satisfies obtained. A.

530.145 : 535.14

8987. ON MATRIX THEORIES OF THE PHOTON. Tzou Kuo-Hsien.
C.R. Acad. Sci. (Paris), Vol. 245, No. 2, 141-4 (July 8, 1957). In French.

In the matrix formulation of electrodynamics two theories are possible for the photon, one with six and one with three components. It is shown that both theories are invariant with respect to either space or time reversal. L.Pincherle

530.145

8988. QUANTUM ELECTRODYNAMICS AND HILBERT SPACE THEORY. J.G.Taylor.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 4, 719-33 (1956).

Describes an attempt to formulate quantum field theory, in particular quantum electrodynamics, in terms of Hilbert space theory. The work of Cook is extended to give a precise description of non-interacting electrons and positrons. The hole interpretation is not required in this extension, and no subtraction formalism is required. It is shown that the formalism can never reduce to that of intuitive quantum field theory except by an abuse of language associated with the δ-function. Interaction cannot be introduced in a simple manner into the rigorous formalism, so it seems extremely difficult to develop the Hilbert space formalism for quantum field theory in any useful manner. These difficulties indicate that an investigation of the Hilbert space basis of simple quantum theory is necessary before a rigorous mathematical formalism for intuitive quantum field theory can be developed. A.

530.145

8989. PION–NUCLEON INTERACTION AND STRANGE PARTICLES. P.Budini and L.Fonda.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 306-8 (Jan., 1957).

A non-local theory of the pion–nucleon interaction is proposed, embodying the concept of an intermediate field which is identified with the parity-doubled K-meson field. J.W.G.Wignall

530.145

8990. PROPAGATION KERNELS AS FUNCTIONS OF THE MASSES. E.R.Caianiello.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 739-41 (March, 1957).

Some results on propagation kernels in renormalization theory are presented. They may be of practical use in cases where the usual perturbation expansions do not seem appropriate, e.g. in some of the current non-covariant meson theories. W.A.Hepner

530.145 : 539.18

8991. LOW ENERGY $\bar{K}$–NUCLEON SCATTERING. D.Amati and B.Vitale.
Nuovo Cimento, Vol. 6, No. 2, 261-5 (Aug., 1957).

The low-energy scattering of $\bar{K}$-mesons on nucleons is studied using a similar method to that applied, in a previous work, for the K–N interaction. Disregarding virtual baryon–antibaryon pair effects, K virtual state contributions and baryon recoil, the integral equations for the two isobaric spin state amplitudes are exactly solved, and analytical expressions for the phase shifts are given. Results depend little on the cut-off energy and indicate repulsive potential for both isobaric spin eigenstates. Numerical results are presented for the values of the coupling constants suggested in the previous work. A.

530.145

8992. INVARIANCE PROPERTIES OF FERMI INTERACTIONS. D.L.Pursey.
Nuovo Cimento, Vol. 6, No. 2, 266-77 (Aug., 1957).

The effect of vanishing observable neutrino mass on the conditions that Fermi interactions should be invariant under P, T, and C is investigated. A minor correction is given to the formula for β–ν angular correlation given by Lee and Yang. Results are obtained which reduce the labour of extending existing calculations to interactions which are not invariant under P, T or C. Some obscurities in the existing literature on β-spectrum shape correction factors are clarified. It is shown that in μ-meson decay, to lowest order, there can be no interferences between the group interactions (V, A) and the group (S, T, P). An alternative to Salam's neutrino gauge hypothesis is indicated. The foundations of the method used in the paper are discussed. A general theorem on weak interactions which are invariant under P but not under T or C, together with two corollaries, is stated in an appendix, and the proof is outlined. A

530.145

8993. ON SYMMETRIES IN ELEMENTARY PARTICLE INTERACTIONS. B.D'Espagnat, J.Prentki and A.Salam.
Nuclear Physics, Vol. 3, No. 3, 446-55 (May, 1957).

It is investigated how far the number of independent coupling constants in the interaction Lagrangian of elementary particles can be reduced by various covariance requirements in [3]- and [4]-manifolds. A.

530.145

8994. ON THE POLARIZATION PROPERTIES OF CHERENKOV RADIATION. A.A.Sokolov and Yu.M.Loskutov.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 630-2 (1957). In Russian.

A calculation of the intensity and polarization of the radiation for particles with and without spin. W.O.Lock

530.145

8995. CHARGED VECTOR FIELD OF ZERO PROPER MASS. K.-H.Tzou.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 289-91 (July 17, 1957). In French.

No charged particles of zero proper mass are known, but there seems to be no general reason why they should not exist. In this paper the interaction of an electromagnetic field with a charged vector field of spin 1 is formulated for the case of zero proper mass. It is shown that the proper magnetic moment should be twice as large as in the usual theory. P.M.Davidson

530.14

8996. ANTINUCLEONS. RICHTMYER LECTURE 1957. E.Segrè.
Amer. J. Phys., Vol. 25, No. 6, 363-9 (Sept., 1957).

The author describes the historical background on antiparticles and the experimental work that led to the discovery of the antinucleons. Many of the properties of the antiproton which can be predicted exactly on the basis of Dirac's theory have been verified. The outstanding problem is now to find the other properties which cannot be predicted on the basis of Dirac's theory and a start in this direction has been made. The latest experiments on cross-section measurements and modes of annihilation are described. A

530.14

8997. MESONS AND THE STRUCTURE OF NUCLEONS. B.T.Feld.
Ann. Phys. (New York), Vol. 1, No. 1, 58-76 (April, 1957).

An atomic model of the physical nucleons is considered in which the structure is represented as a nucleon core surrounded by a pion cloud in a $p_{1/2}$ state, the system being in a state of isotopic spin ½. From the pion wave-function, constructed on this basis, the static properties of the physical nucleons — magnetic moments,

charge distributions, mass difference — are derived and compared with observation. Modifications are considered which could bring the predictions of this model into better accord with the experiments. It is shown that the core must be given properties, both of size and of structure, which deviate considerably from those of the Dirac nucleons. Some discussion is given of the relationships of the atomic model to meson field theories. A.

530.145

8998. AN APPROXIMATION FOR THE PHYSICAL NUCLEON IN THE FIXED-SOURCE THEORY. W.Królikowski.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 3, 263-8 (1957).

A perturbation approximation is used to obtain expressions for the masses of the ground states of the four isobars on the physical nucleon model proposed in previous notes (Abstr. 5051-2/1957). N.M.King

530.145 : 539.18

8999. AN ESTIMATE OF MASSES OF ISOBARS OF THE NUCLEON IN THE FIXED-SOURCE THEORY. W.Królikowski.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 3, 269-72 (1957).

Expressions obtained in a previous note (see preceding abstract) are evaluated for a "reasonable" shape of meson cloud. The resulting masses are compared with experimental values for the four baryons N, Λ, Σ, Ξ, and satisfactory agreement is established. N.M.King

530.145

9000. ON THE ENERGY–MOMENTUM TENSOR DENSITY FOR SIMPLE POLE PARTICLES. W.Tulczyjew.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 3, 279-82 (1957).

The object of this paper is to show that the form of the energy–momentum tensor density is completely determined by the field equations of the general relativity theory. W.A.Hepner

530.145 : 530.12

9001. EQUIVALENCE OF THE TENSOR AND SPINOR DESCRIPTIONS OF THE SPIN $\frac{1}{2}$ CORPUSCLE. A.Aymard.
C.R. Acad. Sci. (Paris), Vol. 244, No. 26, 3133-6 (June 24, 1957). In French.

Tensor equations expressed in terms of the author's tetrad formulation (Abstr. 2977-8/1957) are shown to be equivalent, in Minkowski space–time, to Dirac's spinor equations. A physical vector wave associated with the particle is found to be of frequency 2 W/h, and not W/h as for the photon tensor wave. R.A.Newing

530.145

9002. ON THE STRUCTURE OF THE ELECTRON.
G.Jakobi and N.Kolesnikov.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 286-9 (July 17, 1957). In French.

The equivalence is shown, in the static case, of a non-linear theory of Born–Infeld type to a linear theory with extended source. A charge distribution with everywhere the same sign is found to be impossible. J.S.Bell

530.145

9003. ON ADMISSIBLE TRANSFORMATIONS FOR THE EQUATIONS OF PARTICLES WITH HIGHER SPIN.
É.E.Fradkin and S.V.Izmaĭlov.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 2, 277-80 (1957). In Russian.

A general contact transformation applied to the wave equations of a higher-spin particle is investigated; the limitations imposed by Lorentz invariance and the conservation laws are discussed and exemplified by displaying the transformation matrix diagrammatically. J.W.Gardner

530.145

9004. ON THE CONSERVATION OF NUCLEONS. B.Ferretti.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 761 (March, 1957).

A continuation of previous work (Abstr. 5059/1957).

530.145

9005. CAUSALITY AND THE DISPERSION RELATION: S-MATRIX FOR THE MAXWELL FIELD. D.Y.Wong and J.S.Toll.
Ann. Phys. (New York), Vol. 1, No. 1, 91-111 (April, 1957).

The scattering of a classical Maxwell field by a fixed spherically symmetric scatterer of finite range is considered. This problem is easily related to the scattering of a scalar field which is considered first. The condition of strict causality is imposed on the forward scattering of a sequence of primary scalar wave packets $\{\psi_p^{(n)}\}$, $n = 0, 1, 2, \ldots$, in which the nth primary wave contains only partial waves for $l \geq n$. This implies that the dispersion relation is satisfied by each member of an infinite set of causal amplitudes which are expressed as combinations of the elements of the S-matrix $\{S_l(\omega)\}$. Inverting the relation for the causal amplitudes in terms of the S-matrix, one obtains a set of dispersion formulae which give $\mathcal{I}m\, S_m(\omega)$, for each m, in terms of combinations of the $\mathcal{R}e\, S_l(\omega)$'s plus the low energy limits of $[S_l(\omega)/\omega^{2l+1}]$ for all $l \geq m$. Hence the real part of the scattering amplitude, for all angles and frequencies, is determined by the knowledge of its imaginary part plus the low energy limits of $[S_l(\omega)/\omega^{2l+1}]$. Corresponding formulae exist for $\mathcal{R}e\, S_m(\omega)$ and the imaginary part of the scattering amplitude. If a perturbation expansion method is valid, then the restriction is much stronger, namely, low energy limits determine all phase shifts, or, equivalently, the s-wave phase shift determines the phase shift for all higher angular momenta. The scattering of the Maxwell field is described by three matrices, corresponding to the two transverse modes and one longitudinal mode; each of these matrices is shown to satisfy the same set of dispersion relations as that for scalar waves, except for the omission of the s-wave equation in the case of transverse modes. The equivalent formulation of the derivation of the dispersion relations for the S-matrix in terms of the vanishing of commutators is given in an appendix for the case of the scattering of scalar wave by a static potential. A.

530.145

9006. SCATTERING BY TWO POTENTIALS. D.Park.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 291-3 (July 17, 1957). In French.

An extension of previous work (Abstr. 4827/1956) on the quantum theory of a system under the influence of two interactions (scattering of particles by two potentials). P.M.Davidson

530.145 : 530.12

9007. RELATIVISTIC COLLISION INTERVAL. N.A.Chernikov.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 3, 530-2 (1957). In Russian.

The problem solved is that of finding the probability that a particle with given spatial and temporal coordinates and given velocity makes a collision in matter in the proper-time interval $d\tau$. This probability is obtained in terms of the probability that the particle is at the given point and the "radius of interaction". G.E.Brown

530.145

9008. THE HIGH ENERGY LIMIT OF THE POTENTIAL SCATTERING. I. NON RELATIVISTIC KINEMATICS. M.Verde.
Nuovo Cimento, Vol. 6, No. 2, 340-54 (Aug., 1957).

Some asymptotic expansions of the phase shifts have been derived, corresponding to high energies and a non-relativistic potential scattering. They are valid for small as well as large values of the angular moments and are obtained using the Gel'fand and Levitan operator which gives a uniform connection of two complete bases in the Hilbert space. An approximation of the total scattering amplitude is also presented, whose validity extends to all angles of scattering with the exception of the vicinity of 180°. Some remarks are made on the problem of obtaining the potential from the knowledge of the phase shifts for a fixed energy as function of the impact parameter. A.

530.145

9009. CONSTRUCTION OF THE SCATTERING MATRIX OF A TWO-NUCLEON SYSTEM. L.Puzikov, R.Ryndin and J.Smorodinsky.
Nuclear Physics, Vol. 3, No. 3, 436-45 (May, 1957).

The problem of the number of experiments which are necessary for the determination of the elements of the elastic scattering matrix is discussed. It is shown that in virtue of the unitarity condition the required number of experiments equals the number of complex functions entering the scattering matrix. In the case of nucleon–nucleon scattering the elastic scattering matrix can be determined on basis of five experiments: measurement of the cross-section, polarization, normal component of the polarization correlation tensor and the normal components of the triple scattering tensor (for both particles). It is shown that experiments with rotation of polarization by the external magnetic field are not necessary for phase-shift analysis. A.

530.145 : 539.18

9010. POSSIBLE EXISTENCE OF A HEAVY NEUTRAL MESON. Y.Nambu.
Phys. Rev., Vol. 106, No. 6, 1366-7 (June 15, 1957).

Attempts to account for the charge distribution of the proton and neutron by introducing a heavy neutral meson, ρ^0, [vector, isotopic scalar, $M \sim (2\text{-}3)\, m_\pi$], which can contribute a form factor to electron–nucleon scattering by virtue of the process: $\rho^0 \rightarrow e^+ + e^-$. Some consequences of this suggestion are listed. K.H.Barker

530.145 : 530.162

9011. IS QUANTUM MECHANICS A SPECIAL CASE OF CLASSICAL STATISTICAL MECHANICS? F.Bopp.
Ann. Inst. Poincaré, Vol. 15, No. 2, 81-112 (1956). In French.

It is shown that quantum systems can be represented by a Gibbs assembly of points in phase space, and the equation of motion of the assembly is derived. It has two classes of solutions, completely separate. A study of this equation shows the significance of Heisenberg's relation. It is shown that all quantum phenomena, including diffraction, can be interpreted without abandoning the corpuscular view of matter. P.M.Davidson

530.145

9012. IS A CAUSAL INTERPRETATION OF QUANTUM THEORY POSSIBLE? F.Cap.
Ann. Inst. Poincaré, Vol. 15, No. 2, 113-22 (1956). In French.

This paper examines the possibility of retaining causality by attributing the existence of quantized states to stabilizing forces which only vanish in those states. P.M.Davidson

530.145

9013. ON THE WAVE-FUNCTIONS ASSOCIATED WITH THE MOVEMENT OF PARTICLES IN WAVE MECHANICS. G.Petiau.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 293-6 (July 17, 1957). In French.

This paper, based on the usual wave equations, seeks to give an improved representation of a moving particle by introducing, in addition to the regular solutions usually considered, singular solutions representing the detailed structure of the particle.

P.M.Davidson

530.145 : 530.12

9014. DIRAC EQUATIONS IN THE GENERAL RELATIVISTIC SCHEMA. J.M.Souriau.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 496-7 (July 29, 1957). In French.

The Lagrange function for the Dirac equations is expressed in form consistent with the author's general variational system, the "variables of state" being taken to be four spinor components and a complex scalar. R.A.Newing

530.145

9015. METHOD OF APPROXIMATION OF RAPID CONVERGENCE FOR THE WAVE-FUNCTIONS OF THE ANHARMONIC OSCILLATOR. J. Ruamps.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 643-4 (Aug. 5, 1957). In French.

Parametric representation of $\psi_\nu(x)$ in the form $\psi_\nu = f(x)\varphi_\nu(x)$ enables a rapidly converging approximation to be derived.

G.I.W.Llewelyn

530.145

9016. SUMMATION OVER FEYNMAN HISTORIES: THE FREE PARTICLE AND THE HARMONIC OSCILLATOR. H.Davies.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 1, 199-205 (Jan., 1957).

Using a particular parametrization of paths, the free particle and the harmonic oscillator are treated by the Feynman method of summation over histories of the system. The propagators obtained are, apart from an arbitrary phase factor, those of conventional quantum mechanics. A.

530.145 : 539.11

9017. ON BOHM–PINES THEORY OF PLASMA. W.Schützer.
An. Acad. Brasil Ciênc., Vol. 28, No. 4, 419-22 (1956).

It is shown that in the quantum-mechanical treatment of a dense electron gas, the equations derived by Bohm and Pines (Abstr. 1278/1954) can be obtained by an alternative method, which has certain advantages, including a simpler and more easily visualized treatment of damping. P.M.Davidson

530.162

9018. A MODIFICATION OF SMOLUCHOWSKI'S DIFFUSION EQUATION. R.A.Sack.
Physica, Vol. 22, No. 10, 917-18 (Oct., 1956).

Starting from the Fokker–Planck equation for a Brownian particle in a force-field (Kramers), a heuristic argument is given in favour of adding a second time-derivative to the Smoluchowski equation in coordinate space so as to obtain an equation valid also for times nearer the start of the process than the relaxation time. The resulting equation is similar to, but not the same as, the "first approximation" of Brinkman (Abstr. 2701/1956). R.O.Davies

530.162

9019. ON IRREVERSIBLE PROCESSES IN NON-UNIFORM SYSTEMS. I.Prigogine and J.Philippot.
Physica, Vol. 23, No. 6, 569-84 (June, 1957).

Considers irreversibility in inhomogeneous, weakly-coupled systems by the methods of Brout and Prigogine (Abstr. 7167/1956) and is thus concerned with the question of time-evolution in complete phase space (actions and angles) and not merely in action space. In particular, it discusses to what extent one can simply superimpose terms due to "mechanical currents" and to collisions – as is assumed in the Maxwell–Boltzmann theory. The problem of weakly-coupled oscillators is described by an ensemble of Fourier coefficients. An H-theorem is established which shows that an arbitrary initial distribution goes over to one homogeneous in space provided that certain interference terms – lacking from the Boltzmann equation – are retained. The theory of Brownian motion of coupled oscillators (Prigogine and Balescu, Abstr. 8441/1957) is extended to the non-homogeneous case and it is shown to be governed by a differential equation, different to that of Kramers, which describes a non-Gaussian Markoff process. The fundamental solution of this equation in phase space is obtained. The authors obtain a diffusion equation governing the propagation of perturbations in anharmonic solids and they also consider the characteristic relaxation times of solids in relation to the specific heat. A simple formula is obtained linking the thermal conductivity of a "classical" solid with its specific heat. R.O.Davies

530.162

9020. ON THE GENERAL PERTURBATIONAL TREATMENT OF IRREVERSIBLE PROCESSES. I.Prigogine and F.Henin.
Physica, Vol. 23, No. 6, 585-96 (June, 1957).

By an extension of the methods of Brout and Prigogine (Abstr. 7167/1956) it is shown that there is a direct connection between the reversible equations of mechanics and the irreversible equations, and that this is true even when the perturbation is sufficiently strong to affect the equilibrium properties of the system. Some general properties of the approach to equilibrium are established, especially its asymptotic form and its self-adjoint character. The essential differences from the weakly-coupled case lie in the loss of the "molecular chaos" property and the necessity of treating the system as a whole. In an appendix, the authors consider briefly the effect of external, time-dependent forces on the approach to equilibrium. R.O.Davies

530.162

9021. A STUDY OF THE "IRREVERSIBILITY PARADOX" FOR A SIMPLE STATISTICAL ASSEMBLY. H.N.V.Temperley.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 4, 712-18 (1956).

A very simple model, consisting of N particles moving in a one-dimensional assembly divided by potential "humps" into M cells, is studied. The process of passing from a quantum mechanical description of such an assembly to the equation of diffusion type that governs it in practice is shown to consist of at least three separate steps: "averaging over phases", and letting N and M become large. The effects of these steps are considered separately. Strict irreversibility in time appears after the first step, but the assembly remains ergodic until after the second step and fluctuations persist until after the third step. A

GENERAL MECHANICS. MECHANICS OF SOLIDS 531

531.133 : 531.789.1 : 531.8

9022. A SYSTEM FOR RECORDING TRANSMISSION ERRORS IN UNIVERSAL JOINTS. A.J.Bartley and R.W.Gregory.
Brit. J. appl. Phys., Vol. 8, No. 9, 355-60 (Sept., 1957).

This paper describes the development of a new system for recording the "performance characteristics" of universal joints. The system is described in detail and some test results obtained with a single Hooke's joint are included. The system could also be used for recording the twist in a shaft subject to torque and would be most suitable for use on shafts where the twist is to be measured over two reference points which are so remote from each other that more conventional systems could not be used. A

531.25 : 535.55 : 539.37

9023. OPTICAL CONSTANTS OF VISCOELASTIC MATERIALS. L.Villena, D.Tinaut and J.Montilla.
An. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 7-8, 127-38 (July-Aug., 1957). In Spanish.

An experimental study is presented of some mechanical and optical properties of a wide range of transparent plastics with a behaviour which changes from pure elastic to visco-plastic through the intermediate states. A.

MECHANICAL MEASUREMENTS 531.7

531.715.2

9024. AN OPTICAL PROBE FOR ACCURATELY MEASURING DISPLACEMENTS OF A REFLECTING SURFACE. K.W.T.Elliott and D.C.Wilson.
J. sci. Instrum., Vol. 34, No. 9, 349-52 (Sept., 1957).

The probe described is capable of accurately measuring the displacement of a plane reflecting surface along its normal without making mechanical contact with it. The image of an illuminated grating of special construction is formed on the surface to be observed, and the light reflected from this surface then forms an image of equal size on a second, exactly similar, grating. The disposition of the second image relative to the second grating depends upon the position of the probe relative to the plane surface and changes in this disposition cause variations in the amount of light transmitted which are detected photoelectrically. It is therefore possible to set the probe at a reproducible distance from the reflecting surface by moving it until a predetermined level of light transmission is reached. Successive settings relative to a fixed surface indicate that the standard deviation of a single setting of the particular probe described is about 0.4μ (1.6×10^{-5} in.). When the probe is used with a calibrated line standard, displacements may be measured with a standard deviation of 0.7μ (2.8×10^{-5} in.). A.

531.793

9025. A HALF-SILVERED MIRROR TANGENTIMETER. H.J.G.Hayman, F.Deutsch and H.Tabor.
J. sci. Instrum., Vol. 34, No. 8, 307-8 (Aug., 1957).

In order to measure the slope of a curve at a given point, a vertical half-silvered mirror is set perpendicular to the curve by rotating it until the reflection of one half of the curve in the mirror coincides as nearly as possible with the other half of the curve, seen through the mirror. The instrument is fitted with both a tangent scale and a degree scale and, in favourable circumstances, is capable of an accuracy of $\pm 0.25^{\circ}$. A.

MECHANICS OF FLUIDS 532

532.13

9026. ACTION AND VISCOUS FLOW. A.D.Maude; T.V.Starkey.
Brit. J. appl. Phys., Vol. 8, No. 8, 343-4, 344 (Aug., 1957).

The first author raises fundamental objections to Starkey's theory (Abstr. 1575/1955, 1884/1956, 5100/1957) of the equivalence of viscosity and action per unit volume, and of vortices centred on suspended particles in a flowing viscous fluid, and suggests an approach which would avoid some of them. The principle of least action does not require suspended particles to move to the region of least shearing in the centre of a pipe.

In a reply the second author suggests that the alternative approach is unnecessary. J.G.Oldroyd

532.517

9027. A NEW SELF-RECORDING RHEOGONIOMETER. A.F.H.Ward and P.Lord.
J. sci. Instrum., Vol. 34, No. 9, 363-6 (Sept., 1957).

A rheogoniometer of the cone-and-plate type has been designed, in which either a continuous rotation or a simple harmonic motion can be imposed on the cone. The torque transmitted through the fluid, and also the normal thrust between the plates, are measured by capacitance gauges. The torque, thrust and applied motion are shown on a c.r.o. screen and can be photographed. A.

MOLECULAR THEORY OF LIQUIDS 532.7

532.7

9028. ON THE THEORY OF LIQUIDS. L.Goldstein.
Ann. Phys. (New York), Vol. 1, No. 1, 33-57 (April, 1957).

Concerns the exact analytic forms of correlation functions of liquids and some of their macroscopic properties which these correlations determine. Since these functions are expressible in terms of the scattering structure factors of liquids, the macroscopic properties they define are described in terms of the properties of the structure factors. One is then led, with some limitations, to a rigorous result on the behaviour of pair potential energies of isolated stationary atoms at close separations. Part of the paper is devoted to a discussion of some of the limitations of the experimentally derived structure factors as well as the liquid correlation functions to which they give rise. It is shown, on the basis of liquid helium data, that improvements in the empirical correlation functions as well as the various macroscopic liquid properties they define, require the knowledge of the structure factors over a far wider range of the momentum changes on scattering than obtained heretofore. The final topic concerns a detailed study of the asymptotic, large atomic separation, behaviour of the correlation functions. The temperature limitations of a direct method yielding these asymptotic forms are obtained. A new method of derivation of these forms, involving the scattering structure factors, is described. This same method also leads to the asymptotic form of the structure factors themselves, at large values of the momentum changes on scattering. These latter asymptotic structure factors retain their validity over the whole temperature interval of existence of liquids. A.

532.7 : 530.162

9029. THE SECOND-ORDER THEORY OF CONFORMAL SOLUTIONS. W.B.Brown.
Proc. Roy. Soc. A, Vol. 240, 561-80 (July 16, 1957).

Describes a theoretical contribution to the statistical thermodynamics of mixtures of spherical molecules. The second-order perturbation free energy of a conformal solution is obtained by a rigorous Taylor-series expansion of the configuration integral in powers of the differences between intermolecular energy and size parameters, about an ideal unperturbed reference solution. Unlike the first-order terms, those of the second order contain statistical functions of the reference solution which cannot, in general, be related to its thermodynamic properties. All but one of these functions are concerned with departures from a random molecular distribution, and have been called molecular fluctuation integrals; the remaining function can be related exactly to thermodynamic properties for the Lennard-Jones form of the intermolecular potential. The expressions for the molecular fluctuation integrals implied by the full random mixing approximation and by the semi-random mixing approximation of the cell theory, are derived and compared with the correct expressions given by the cell theory. The role of the Taylor series expansions as a critique of solution theories is discussed. A.

532.7 : 534.614

9030. THE COMPRESSIBILITIES, FREE VOLUMES AND EQUATION OF STATE FOR MOLTEN ELECTROLYTES: SOME ALKALI HALIDES AND NITRATES.
J.O'M.Bockris and N.E.Richards.
Proc. Roy. Soc. A, Vol. 241, 44-66 (July 23, 1957).

An apparatus has been devised to measure the velocity of ultrasonic vibrations through liquids at temperatures up to 1000°C by a phase-interference method. Velocities of sound through molten salts have been measured up to a maximum temperature of 1000°C for LiCl, NaCl, KCl, CsCl, $CdCl_2$, LiBr, KBr, CsBr, NaI, KI, $LiNO_3$, $NaNO_3$ and KNO_3. Traces of water do not affect the velocities, which increases linearly with $T^{1/2}$. The isothermal compressibility (β_T) increases approximately linearly with the square of the mean radius of the ions of the salts. β_T increases with increase of temperature. Increase of the ratio of the specific heats, C_p/C_V, and decrease of C_V occur upon increase of the size of X for a given M in a series MX and vice versa. The free volumes (V_f) increase with the increasing particle size and increase of temperature. From β_T the internal pressures are calculated and these enable a satisfactory equation of state to be evaluated. Approximate values of the repulsive exponents in the equation for the energy of the liquid lattice vary from 9.9 (LiBr) to 12.5 (KBr). Comparison of the free volumes with the changes in volume on melting, ΔV, indicate the major role played by holes in the structure of these liquids. This is confirmed by the decrease of the coordination number observed on melting. A detailed model for the ionic liquid is proposed and gives excellent agreement

with experiment in respect of calculations of compressibility and expansivity. A modification of the sound-velocity method for the calculation of free volumes is suggested, and the values of V_f so calculated are compared with those calculated from a method involving the equation of state and the internal pressure values. A relation between the hole volume and free volume is adduced and lends support to the model for molten salts developed. Consideration of the temperature coefficient of free volume gives conclusive evidence concerning the rate-determining step in viscous flow. The cell properties of the model are utilized together with the free volumes to calculate partition functions and evaluations using these of heat capacities and entropy changes are in agreement with experiment.

A.

532.7 : 539.152.1

REVERSIBILITY AND IRREVERSIBILITY IN NUCLEAR RESONANCE. THEORY OF NUCLEAR RELAXATION IN LIQUIDS.
See Abstr. 8771

532.74

9031. CORRELATION BETWEEN VISCOSITY COEFFICIENT AND STRUCTURE OF A SUBSTANCE IN THE LIQUID STATE.
A.Z.Golik and D.N.Karlikov.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 2, 361-4 (1957). In Russian.

The curves for temperature dependence of the viscosity and heat of vaporization of various substances of similar molecular structure have been found to be the higher, and the temperature–compressibility curves lower, the higher their critical temperatures. It was also found that the temperature–viscosity curves of solutions of zinc and cadmium in mercury fall between the curves for the pure components and lie the higher, the greater the critical temperatures of the solutions and that solutions of identical critical temperature have coincident temperature–viscosity curves; they have been called "isoviscous". The plots of intensity of scattering of X-rays against $\sin\theta/\lambda$ of isoviscous solutions were found to be coincident, and from this it is deduced that isoviscous liquids have identical near orders and identical molecular structures. R.C.Murray

532.77 : 535.371

9032. DETERMINATION OF MOLECULAR VOLUMES IN SOLUTIONS BY POLARIZATION LUMINESCENCE.
N.D.Zhevandrov and V.P.Nikolaev.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 5, 1025-8 (1957). In Russian.

Since the equation for p, the degree of polarization of fluorescence, is given by $1/p = p_0^{-1} + (p_0^{-1} - \frac{1}{3})RT\tau/V\eta$, where p_0 is the fluorescence polarization limit, τ the lifetime of the excited state, measurements of p can yield information about V the molecular volume of a substance in different solvents and at various concentrations, thus throwing light on solvation, etc. The method is applied to the determination of the molecular volumes of various anthracene, acridine, and aminophthalimide derivatives in glycerine, castor oil, and vaseline oil. It is shown that the results cannot in all cases be interpreted on the basis of molecular volume differences alone, but indicate differences in macro and micro (molecular) viscosities. The lack of correlation between the effective molecular volumes calculated from the results and dipole moments of the dissolved substances is discussed. R.C.Murray

MECHANICS OF GASES 533

533.51

9033. THE KNIFE-EDGE VACUUM SEAL.
G.W.Hees, W.Eaton and J.Lech.
Vacuum, Vol. 4, No. 4, 438-44 (Oct., 1954; publ. June, 1957).

A reliable high-vacuum sealing technique of wide applicability and capable of containing an ultra-high vacuum is described. This seal can readily be assembled or disassembled. It can withstand repeated and prolonged bakeouts as well as liquid nitrogen temperatures. Seals ranging from less than one inch to more than twelve inches in diameter have been constructed. A wide variety of materials have been joined. A.

533.56

9034. SOURCES, MEASUREMENT AND CONTROL OF BACKSTREAMING IN OIL VAPOUR VACUUM PUMPS.
B.D.Power and D.J.Crawley.
Vacuum, Vol. 4, No. 4, 415-37 (Oct., 1954; publ. June, 1957).

In all vapour diffusion pumps working fluid vapour continuously backstreams through the pump inlet to an amount depending on the design and method of operating the pump, with the result that the vapour pressure in the pumped system is increased beyound that corresponding to the temperature of the pump-cooling water, and undesirable condensation of fluid in the system may ensue. The sources of the backstreaming vapour are studied and methods of control discussed which do not adversely affect the pump performance. A critical review is made of various methods of measuring backstreaming, and the technique adopted by the authors is described. The lip of the top jet nozzle is shown to be an important source of backstreaming, and a qualitative explanation for this is put forward. Two new control devices are then described: One, a cooled "guard ring" around the nozzle lip which intercepts the backstreaming vapour at source, and the other, a nozzle with a controlled temperature gradient along its wall which is intended to condense the randomly moving outer layer of the vapour jet from which the backstreaming molecules originate. This principle is actually contrary to recognized good practice. A.

533.57

9035. PUMP COMBINATIONS FOR HIGH VACUUM APPARATUS.
W.Hänlein and K.G.Günther.
Z. angew. Phys., Vol. 8, No. 12, 603-7 (Dec., 1956). In German.

Present day technical vacuum systems require diffusion pumps with high pumping speeds over a wide pressure range. This places greater demands on the rotary backing pump. In order to keep the size and cost of this pump within reasonable limits, a mercury diffusion pump may be interposed between the rotary pump and the diffusion pump. In order to reduce the contamination of the mercury by oil vapour, a suitably disposed thermal trap is used, consisting of a coil of wire heated to about 500°C. A vacuum system operating on these principles is described. T.Mulvey

533.58

9036. ULTRA-HIGH VACUA. J.Yarwood.
J. sci. Instrum., Vol. 34, No. 8, 297-304 (Aug., 1957).

The use of the ionization gauge both as a pump and as a measuring instrument in the pressure range from 10^{-6} to 10^{-11} mm of mercury is discussed. Experimental results indicate that Alpert's claims regarding electrical pumping speed are justified provided that the initial pressure is sufficiently low. Suggestions are made regarding the disparities between Alpert's results and those of other workers. The omegatron is described and a short survey given of those factors which set the limit to the lowest pressures attainable in a glass envelope. A.

533.585 : 541.124

9037. THE OXIDATION OF EVAPORATED BARIUM FILMS (GETTERS). R.N.Bloomer.
Brit. J. appl. Phys., Vol. 8, No. 8, 321-9 (Aug., 1957).

Mott's theory of the oxidation of metals is summarized and expressed in terms comparable with the throughput, capacity, and speed of pumping, which are measured in the present work on barium getters. It has been found that there is a critical temperature, about 40°C for barium, below which a thin protective film of oxide is formed. Above 40°C, barium films oxidize right through, and so in this case, the capacity of getters for oxygen depends upon the amount of metal used. The feature of the mechanism which limits the speed of pumping of oxygen has been found, and hence the speed has been increased in various ways. The theory of Mott concerns only the growth of an oxide film that is already at least a monolayer thick. In the present study it has been found that the first monolayer spreads from nucleation centres in the barium surface. A.

533.58

9038. BARIUM GETTERS AND CARBON MONOXIDE.
R.N.Bloomer.
Brit. J. appl. Phys., Vol. 8, No. 9, 352-5 (Sept., 1957).

The absorption of carbon monoxide by evaporated barium films has been studied in a pressure range 10^{-6}-10^{-7} mm of mercury. The mechanism is shown to be similar to that for oxygen (see preceding abstract and Bloomer, Nature (London), Vol. 179, 493, March 2, 1957), and is explained with the aid of Mott's theory. Carbon monoxide is dissociated at the surface of the barium film, and an oxide layer containing free carbon is formed. Below 80°C, the layer of reaction products is protective once it has grown to a thickness of about 50 A. Above 80°C the whole of the barium is used up in the reaction. The condensation coefficient at room temperature is 0.012. Thus, about 1 in 80 of the carbon monoxide molecules striking the getter surface in any period is taken up by a barium film at room temperature (1 in 40 at 170°C). The condensation coefficient is limited to these low values by the superficial density of interstitial barium ions in the free surface of the oxide

layer. A nearby ionizing discharge has very little influence upon the fraction of incident molecules which is condensed upon and taken up by a barium film. A.

MOLECULAR THEORY OF GASES 533.7

533.7

9039. BOUNDARY VALUE PROBLEMS IN KINETIC THEORY OF GASES. E.P.Gross, E.A.Jackson and S.Ziering.
Ann. Phys. (New York), Vol. 1, No. 2, 141-67 (May, 1957).

The state of a gas, flowing between two parallel plates, is analysed from the viewpoint of kinetic theory. When the mean free path is infinitely greater than the distance between the plates, the exact solution shows that the distribution function is discontinuous in velocity. One must distinguish between molecules impinging on a plate and those leaving. The authors investigate the problem of finding a theory valid for arbitrary ratio of mean free path distance, and of plate speed to sound speed. This is most easily achieved by splitting the distribution function into the above mentioned parts, and expanding each part in polynomials in velocity space, which are orthogonal over half the velocity range. In every approximation, exact account is given of (1) the microscopic boundary conditions, (2) the conservation laws, and (3) the behaviour in the low pressure region. The method, which can be applied to the Boltzmann equation, is here developed for the kinetic model of Bhatnager, Gross, and Krook. Variational principles are stated by noting the similarity of the linearized version of this theory to the Milne equation of radiative transfer. For the nonlinear, high speed case, a new approach in the low pressure region is indicated. The relationship to alternative methods is discussed. When the distribution function is expanded in full-range orthogonal polynomials it is necessary to go to high order to obtain an adequate representation of the low pressure region, and of the boundary layer. Very simple half-range distribution functions yield an accurate description of the state of the gas. A.

533.7

9040. A RELATIVISTIC FORM OF BOLTZMANN'S TRANSPORT EQUATION IN THE ABSENCE OF COLLISIONS.
P.C.Clemmow and A.J.Willson.
Proc. Cambridge Phil. Soc., Vol. 53, Pt. 1, 222-5 (Jan., 1957).

With the neglect of collisions, a relativistic form of Boltzmann's transport equation is derived and its invariance under a Lorentz transformation is established. A.

VIBRATIONS. ACOUSTICS 534

534.01

9041. ON THE SHORT-WAVE ASYMPTOTIC THEORY OF THE WAVE EQUATION $(\nabla^2 + k^2)\phi = 0$. F.Ursell.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 1, 115-33 (Jan., 1957).

The present work appears to be the first practical and rigorous solution of a short-wave problem in optics or acoustics when a solution in closed form is not available. It is suggested that the technique (suitably combined with formal expansions) may be applicable to a wider class of radiation and diffraction problems. A.

534.2

9042. PRESSURE PULSES EXERTED ON A SCREEN BY LONGITUDINAL WAVES IN AN ELASTIC MEDIUM. G.Baillard.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 505-7 (July 29, 1957).
In French.

A generalized theoretical treatment of the equations of vibrating strings leads to the conclusion that, in any homogeneous elastic medium, the pressure pulses exerted on a rigid screen by longitudinal waves are of constant amplitude. H.J.H.Starks

534.22 : 532.7

9043. MEASUREMENT OF SOUND VELOCITY IN DOUBLE-DISTILLED WATER AT VARIOUS GAS CONTENTS AND AT VARIOUS TEMPERATURES. H.Markgraf.
Hochfrequenztech. u. ElektAkust., Vol. 65, No. 5, 169-73 (March, 1957). In German.

An interferometer method has been developed for the measurement of sound velocity in liquids. Standing waves are set up between the quartz and the reflector, the position of the latter is set very accurately by means of a micrometer, and the apparatus incorporates facilities for collecting any evolved gas. In the present work double-distilled water has been used from which dissolved gases were removed both by heating under reduced pressure and by the application of ultrasound. The variation of velocity with temperature and with quantity of dissolved air has been measured with, it is claimed, an accuracy of ±0.7 m/sec. It is found that the velocity at constant temperature increases with decreasing gas content, the rate of increase increasing with rising temperature. An equation has been fitted to the results which gives velocity at constant temperature as a function of quantity of dissolved gas. T.C.Toye

534.222.1

9044. ON THE TRANSMISSION OF AN ULTRASONIC WAVE THROUGH AN INDEFINITELY STRATIFIED MATERIAL.
M.L.Gaulard.
C.R. Acad. Sci. (Paris), Vol. 244, No. 20, 2486-8 (May 13, 1957).
In French.

Theoretical expressions are deduced for plane wave propagation through a medium consisting of successive parallel slices of two different materials, the wave being normal to the boundaries. These give forbidden frequencies when the slice width is an integral number of half wavelengths. H.D.Parbrook

534.222.2 : 536.33.08

9045. A BOLOMETER DETECTOR FOR THE MEASUREMENT OF SHOCK VELOCITY IN LOW DENSITY GASES.
J.G.Clouston, L.J.Drummond and W.F.Hunter.
J. sci. Instrum., Vol. 34, No. 8, 321-4 (Aug., 1957).

In applying the shock tube as a device for the study of chemical kinetics it is necessary to measure the velocity of the shock wave so that the energy input is characterized by the shock strength. A suitable detector of a shock wave, used to determine shock velocities, should have adequate sensitivity in order to detect weak shocks in low density gases and also have a high speed of response to reduce timing errors to a minimum. It should also be robust and resistant to corrosive substances and be able to be placed in the shock tube so that the shock front is not disturbed in passing it. This note describes such a detector. A.

534.23 : 534.24

9046. THE REFLECTION AND TRANSMISSION OF A PLANE SOUND WAVE INCIDENT AT ANY ANGLE ON A LAYER-SYSTEM VISCO-ELASTIC MEDIUM. II. S.Kästner.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 102-15 (1956). In German.

For Pt I, see Abstr. 3087 (1957). Materials may be classified acoustically into two groups: those in which compression and shear waves appear (Group A) and those in which only compression waves can be propagated (Group B). The reflection and transmission of plane waves through a layered system of viscoelastic material of Group A was discussed in Pt I; in this part, the propagation of waves through a layered system composed of four different arrangements of Group A and B materials is considered theoretically. H.J.H.Starks

534.232 : 621.395.623.7

9047. ON THE LOW-FREQUENCY RADIATION LOAD OF A BASS-REFLEX SPEAKER. R.H.Lyon.
J. Acoust. Soc. Amer., Vol. 29, No. 5, 654 (May, 1957).

By drawing the equivalent circuit of a port–cone combination of a bass reflex system near the fundamental resonance, the radiation load can be derived. The effect is one of coupling between the "mass plugs" of the radiators, and the mutual inductance varies inversely with the spacing between the port and cone. D.J.Hall

534.321.9 : 621.785

EFFECTS OF ACOUSTICAL WAVES ON THE ANNEALING OF STEELS. See Abstr. 8967

534.37 : 535.214

9048. ACTION OF INFRARED RADIATION ON AN ULTRASONIC STEADY STATE. C.Rossetti.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3038-40 (June 17, 1957).
In French.

Using apparatus previously described (see Abstr. 2289/1953) infrared absorption by a gas in an ultrasonic steady state has been studied. The results lead to two different mechanisms: one of a purely thermal nature and relatively slow, the other of molecular origin and instantaneous. G.F.Hodsman

534.39

9049. THE TORQUE ON AN INFINITE STRIP EXPOSED TO PLANE SOUND WAVES. H.Levine.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 1, 234-47 (Jan., 1957).

The mean torque on an infinite fixed strip due to plane harmonic

sound waves is calculated, employing simple acoustical theory as a basis and neglecting viscosity. In the range of wavelength λ small compared to the strip width δ, the torque is oscillatory. This oscillatory character of the torque in its dependence on δ/λ is not to be found at long wavelengths where, as is well known, the torque acts only in the sense of aligning the strip broadside to the incident wave normal. A.

534.614 : 532.7

MEASUREMENT OF ULTRASONIC VELOCITY THROUGH LIQUIDS AT HIGH TEMPERATURES. See Abstr. 9030

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85

534.833 : 534.845

9050. SOUNDPROOF DOOR CONSTRUCTIONS. H.Börner.
Hochfrequenztech. u. ElektAkust., Vol. 65, No. 5, 173-80 (March, 1957). In German.

The author discusses the theory of sound-insulation of partitions (doors in particular) and deals with Cremer's theory of transverse vibration of a partition. Various composite constructions of doors are described in detail (woods of varying degrees of hardness with glass wool separators forming multilayer constructions). Many sound transmission and/or absorption curves as a function of frequency are reproduced in illustrations. A.B.Wood

534.84

9051. ON STANDARD METHODS OF MEASUREMENT IN ARCHITECTURAL ACOUSTICS. R.V.Waterhouse.
J. Acoust. Soc. Amer., Vol. 29, No. 5, 544-7 (May, 1957).

Suggestions are made pertaining to standard methods of measuring the sound absorption of acoustical materials and the sound transmission loss (S.T.L.) of partitions. (1) Concerning the reverberation chamber method of measuring the sound absorption of materials, it is shown that the absorption varies with the position of the sample in the chamber, owing to interference patterns. An estimate is made of the difference in absorption of a sample on the floor (a) centrally and (b) touching one side wall. It is suggested that sample position should be specified as distant at least half a wavelength ($\lambda/2$) from walls and reflecting surfaces other than the one backing the sample. (2) Regarding the measurement of S.T.L. it is suggested that microphone position be specified as at least $\lambda/2$ from walls and the corresponding distances from edges and corners of reverberation chambers. The technique in which the microphone is placed near a wall is not recommended. (3) As a single figure for the over-all sound insulation value of a partition, the arithmetic mean of the decibel S.T.L. figures at various frequencies is often used. It is suggested that a better average figure is obtained if the linear ratios corresponding to these decibel figures are averaged instead of the decibel figures themselves. This removes the logarithmic weighting of the latter average, for which there is no physical justification. A.

OPTICS. RADIATION. SPECTRA 535

535.14

9052. PHOTONS AND NON-LINEAR ELECTROMAGNETIC THEORY. F.Destouches-Aeschlimann.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3034-6 (July 17, 1957). In French.

Starting from de Broglie's non-linear equations for the wave representing a photon, the equations of a non-linear electromagnetic theory are constructed. P.M.Davidson

535.14 : 535.237

9053. A METHOD OF PRODUCTION OF A NARROW SPECTRUM OF HIGH-ENERGY PHOTONS. C.Tzara.
C.R. Acad. Sci. (Paris), Vol. 245, No. 1, 56-9 (July 1, 1957). In French.

A suggestion to use for this purpose a cascade Bremsstrahlung, pair production, energy selection of the positrons, two-photon annihilation in flight. A rough analysis shows that in many experimental conditions one might expect a reasonable efficiency. The practical realization of the method is not discussed. L.Pincherle

535.14 : 530.145

ON MATRIX THEORIES OF THE PHOTON. See Abstr. 8987

535.23.08

9054. ABSOLUTE RADIOMETRY BASED ON A CHANGE IN ELECTRICAL RESISTANCE. M.Eppley and A.R.Karoli.
J. Opt. Soc. Amer., Vol. 47, No. 8, 748-55 (Aug., 1957).

A blackbody and an electrical method of absolute radiometry employing d.c. instruments for the measurement of current and resistance are described. The blackbody, designed for performance near 1000°C, is an electrically heated tubular furnance containing an oxidized-steel chamber as the radiating source. The radiometer consists, essentially, of a coil of platinum wire wound spirally and bifilar-wise on a blackened, thin, silver disk from which it is electrically insulated but in good thermal contact. The change in resistance of the coil is a measure of the radiation absorbed by the coated disk. By heating the coil electrically, the energy required to produce this change is readily calculated; thus, the deviation of the radiant energy of the source from the corresponding computed perfect blackbody radiation can be determined. This method indicated that the radiant flux emitted by the above source is within 1% of that from such an ideal blackbody at a temperature between 800°C and 1100°C. Included is a description of the apparatus used in the assemblage, as well as of the procedure followed in obtaining data, with a discussion of the probable sources of error. A.

535.317.1

9055. THE OPTICAL IMAGERY OF CURVED SURFACES. T.Smith.
Proc. Roy. Soc. A, Vol. 240, 458-61 (July 16, 1957).

The form of Hamilton's angular characteristic function for the aberrationless imagery of one surface of rotation on another, and the connection between the coefficients of the surface and functional equations, are found. When several optical systems of the type considered are arranged in succession the relations between the coefficients of the individual characteristic functions and those of the combination are obtained. These connections enable all aberrations to be computed without resorting to ray tracing. A.

535.322.4

9056. INFRARED DISPERSION OF LIQUIDS BY CRITICAL ANGLE REFRACTOMETRY. J.H.Jaffe and U.Oppenheim.
J. Opt. Soc. Amer., Vol. 47, No. 9, 782-4 (Sept., 1957).

A critical angle refractometer for liquids in the infrared is described. Arsenic trisulphide prisms are used. In determining the critical angle of refraction, the influence of fringes formed in the thin sample layer is taken into account. Dispersion data are presented for six solvents in the 1-6μ region. A summary is given of the sources of published data on the infrared dispersion of solvents. A

535.324.08 : 535.417

9057. RAYLEIGH INTERFEROMETER FOR THE ANALYSIS OF LIQUIDS. E.Grunwald and B.J.Berkowitz.
Analyt. Chem., Vol. 29, No. 1, 124-9 (Jan., 1957).

A detailed discussion is given of a method for identifying the zero order of achromatic fringes in an industrial type of Rayleigh refractive-index interferometer. The method described involves the use of two monochromatic radiations in addition to the standard white light source. Sample calculations for sodium chloride solutions and for dioxan—water mixtures are cited. S.Tolansky

535.33

9058. TRANSPOSITIONAL MATRIX AND 3nj SYMBOL IN THE THEORY OF COMPLEX SPECTRA. I.B.Levinson and V.V.Vanagas.
Optika i Spektrosk., Vol. 2, No. 1, 10-20 (1957). In Russian.

The matrix relating the different functions obtained by coupling n angular momenta was examined. The matrix form was studied in that case where the types of coupling are characterized by transposition of two momenta. It was shown that all such matrices involve 3 nj symbols which appear by generalization as the well known 6j, 9j and 12j symbols. The basic properties of both 3nj and a summation formula are derived. A 3nj symbol of the second kind is introduced. L.Bovey

535.33 : 535.34 : 548.7

9059. ABSORPTION AND EMISSION OF LIGHT BY IMPURITY CENTRES. A.F.Lubchenko.
Optika i Spektrosk., Vol. 2, No. 4, 439-47 (1957). In Russian.

Develops ab initio the matrix elements for absorption and emission of radiation by impurity (F) centres in an isotropic dielectric. The energy spectrum is evaluated as a function of lattice temperature, and the directional properties of the radiation are also discussed. J.W.Gardner

535.33.03 : 539.172.4

9060. A SINGLE-ISOTOPE MERCURY LIGHT-SOURCE AND A DETERMINATION OF THE THERMAL-NEUTRON CAPTURE CROSS-SECTION OF Au^{198}. Yu.P.Dontsov and A.R.Striganov.
Optika i Spektrosk., Vol. 2, No. 1, 21-8 (1957). In Russian.

Apparatus for the distillation of Hg^{198} (99.3% purity) from neutron irradiated Au^{198} is described. The spectrum was excited by a high-frequency (8-11 Mc/s) discharge and certain lines examined with a Fabry–Perot interferometer. The ratio of the intensities of certain lines for Hg^{199} and Hg^{198} was measured and the capture cross-section found to be $(2.3 \pm 0.7) \times 10^4$ barns. L.Bovey

535.33.03

9061. THE RÔLE OF THE EFFECTIVE CROSS-SECTIONS OF ATOMS DURING EXCITATION OF SPECTRA. S.É.Frish.
Uspekhi fiz. Nauk, Vol. 61, No. 4, 461-90 (1957). In Russian.

Survey article concerned with the inelastic collision processes of electrons with gas particles which play the basic role in the radiation resulting from the passage of a current through the gas or as a result of heating at low pressure. Discusses such topics as: processes determining the intensity of spectrum lines, determination of effective cross-section by the method of electron impact, cascade transitions, the excitation of resonance lines, excitation in stages, effective cross-sections of second order. C.R.S.Manders

535.33.07

9062. DEVICE FOR THE SAFE INTERCHANGE OF THE LENS AND PRISM MOUNTS OF A BAUSCH & LOMB LITTROW SPECTROGRAPH. W.H.Abbitt.
J. Opt. Soc. Amer., Vol. 47, No. 9, 862 (Sept., 1957).

535.33.07

9063. A PROJECTION SPECTRUM COMPARATOR. C.F.Smith.
J. sci. Instrum., Vol. 34, No. 8, 324-6 (Aug., 1957).

A new instrument for the comparison of spectrograms of 10 in. x 4 in. or other standard sizes, produces images in juxtaposition at a magnification of 20 on a 9 in. x 7 in. translucent screen. There are controls for focusing and for the longitudinal, transverse, and radial movements of the spectrum plates, and neutral tint wedges enable the brightness of the images to be equalized. An engraving tool is for the marking of selected spectrum lines, and a photographic attachment is used for the recording of comparison spectra. Wavelengths may be established by interpolation from measurements of known line separations with a micrometer attached to one of the carriages, or by comparison with standard spectrum maps by a beam splitter. A.

535.33.07

9064. AN AUTOMATIC FILTER SPECTROGRAPH.
E.Rohner and M.J.O.Strutt.
Scientia Electrica, Vol. 3, No. 1, 1-15 (1957). In German.

A new automatic spectrometer is described, based on the use of interference filters. It yields spectra of light sources, reflecting surfaces and filters within one second. It may be adjusted for obtaining integral spectral values and colour coordinates of the above objects within one second. A.

535.331 : 535.223

9065. TERTIARY INTERFEROMETRIC WAVELENGTH STANDARDS FROM MEASUREMENTS ON LINES OF THE 2-0 BAND OF CARBON MONOXIDE AND DERIVED WAVELENGTH STANDARDS FOR SOME LINES OF THE 1-0 BAND OF CARBON MONOXIDE. THE VELOCITY OF LIGHT DERIVED FROM A BAND SPECTRUM METHOD. IV.
D.H.Rank, A.H.Guenther, G.D.Saksena, J.N.Shearer and T.A.Wiggins.
J. Opt. Soc. Amer., Vol. 47, No. 8, 686-9 (Aug., 1957).

For Pt III, see Abstr. 4111 (1957). Interferometric wavelength measurements were made on 33 lines of the 2-0 band of CO at 4260 cm^{-1}. These measurements were made relative to R(18) of this band, which had previously been measured against the Hg^{198} green line, and have a relative accuracy of 1 part in 10^7. The R(6) line of the 3-0 band was also measured interferometrically. These data, when combined with results of other investigators, give the following values for constants, all in cm^{-1};

$B_0 = 1.922\,521 \pm 0.000\,003\,5$	$\alpha_e = 0.017\,535$
$D_0 = 6.117 \times 10^{-6} \pm 0.01 \times 10^{-6}$	$\gamma_e = 1.01 \times 10^{-5}$
$B_2 - B_0 = -0.035\,008$	$\beta_e = -1.0 \times 10^{-9}$
$D_2 - D_0 = -1.9 \times 10^{-9}$	$\omega_e = 2169.829$
$B_e = 1.931\,285$	$x_e\omega_e = 13.295$
	$y_e\omega_e = 0.0115$

The precise constants allow wavelengths to be calculated for the 1-0 band at 2143 cm^{-1}. Since accurate measurements in this region are difficult to make, it is felt that these calculated values are more accurate than any measured values so far reported. The value of B_0, when combined with recent microwave results, gives for the velocity of light $c = 299\,793.7 \pm 0.7$ km/sec. A.

535.331 : 539.153.4

9066. THE $3d^{n-1}ng$ AND $3d^{n-1}nh$ ELECTRONIC CONFIGURATIONS OF Mn II. O.García-Riquelme, L.Iglesias and R.Velasco.
An. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 3-4, 77-84 (March-April, 1957). In Spanish.

Using a hollow-cathode discharge in helium as a light source, an extension of the Mn II spectrum up to 10 000 A has been obtained. Tables containing 160 new classified lines and 10 new terms belonging to the electronic configurations $3d^5(^6S)ng$ and $3d^5(^6S)nh$, are given. From the values of the eight ng and nf terms a correction of −2.0 kayser to be applied to the value of the limit $3d^5\,{}^6S$ given by Curtis, has been computed. The resulting value is 126145.0 ± 0.6 kayser which gives an ionization potential of 15.636 ± 0.002 volts. A.

535.331 : 539.153.4

9067. TERMS AND IONIZATION POTENTIALS FOR THE III SPECTRA OF THE PALLADIUM GROUP ELEMENTS.
M.A.Catalán and F.R.Rico.
An. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 3-4, 85-94 (March-April, 1957). In Spanish.

From the structural data known at present for the configuration $4d^{n-1}5s$ and $4d^{n-1}6s$, accurate values for terms, limits and ionization potentials are given, for the second spark spectra of the elements of the second long period (Yt III to In III). A.

535.331 : 539.155.2

9068. QUANTITATIVE SPECTRAL ANALYSIS OF AN ENRICHED URANIUM ISOTOPE MIXTURE.
A.R.Striganov, F.F.Gavrilov and C.P.Efremov.
Atomnaya Energiya, Vol. 2, No. 4, 337-44 (1957). In Russian.

A photographic method on a high dispersion (2A/mm) instrument for analysis of U^{235} and U^{238} isotopes in mixtures has been developed. Calibration graphs relating concentration ratios to the 4244 A line intensities are given in the range 2-90% U^{235}. Impurities (e.g. Fe) do not affect the accuracy. A method not involving the use of standard mixtures is also discussed. The spectral method has advantages of rapidity, low cost and reasonable accuracy (error at 4.0 and 90.0% U^{235} concentration is stated to be ± 2.2 and ± 0.3% respectively). The influence of any U^{234} in the mixture is considered. L.Bovey

535.331

9069. NEW ATOMIC ENERGY LEVELS IN THE Mn II SPECTRUM. L.Iglesias.
J. Opt. Soc. Amer., Vol. 47, No. 9, 852-7 (Sept., 1957).

Seventy-one new atomic energy levels of Mn II have now been discovered: 31 even and 40 odd, belonging to the $3d^6$, $3d^54s$, $3d^54p$, $3s^25s$, $3d^25d$, and $3d^27f$ configurations. With these levels it is possible to classify 324 lines. Moreover, 106 additional lines are now classified with levels already known. A.

535.333 : 535.343 : 548.7

9070. STUDY OF THE ABSORPTION AND EMISSION OF A VERY THIN LAYER OF CuI AT 4.2°K. S.Nikitine and R.Reiss.
C R. Acad. Sci. (Paris), Vol. 244, No. 23, 2788-91 (June 3, 1957). In French.

Samples, 0.3 μ and 0.1 μ thick, of an evaporated layer were studied. Absorption and emission spectra are attributed to transitions involving exciton levels or surface states. B.T.M.Willis

535.337 : 537.525.5

9071. ON THE BROADENING AND DISPLACEMENT OF SPECTRAL LINES IN A GAS DISCHARGE PLASMA.
M.A.Mazing and S.L.Mandel'shtam.
Optika i Spektrosk., Vol. 2, No. 2, 276-8 (1957). In Russian.

From measurements of spectral lines of Ca in a d.c. arc electron densities up to 0.9×10^{17} cm^{-3} were determined. The method consists in separating the broadening by the quadratic Stark effect ($\propto r^{-4}$) and Van der Waal's fprces by ($\propto r^{-6}$) by measuring simultaneously the half-width δ and the displacement Δ of the spectral lines. Since for the quadratic Stark effect $\delta/\Delta = 1.16$ while for Van der Waal's broadening $\delta/\Delta = 2.8$, one can determine δ and Δ separately from such measurements. As a reference line for the measurement of line displacement a hollow-cathode source was used. H.Motz

535.338.3

9072. THE INFLUENCE OF GAS COMPOSITION ON SPECTRAL LINE INTENSITY DURING THERMAL EXCITATION.
O.P.Semenova and A.V.Durkina.
Optika i Spektrosk., Vol. 2, No. 1, 34-42 (1957). In Russian.

The intensities of the Na (5890 A, 6161 A) and Cu (5105 A, 5153 A) lines in various mixtures of these with carbon and oxygen are theoretically deduced over the temperature range 3000° to 8000°K from conditions of thermal equilibrium. The Ca (4226 A), Cd (3261 A), B (2497 A) and Al (3944 A) lines are also briefly treated. The dependence of the intensity on the mixture composition over certain temperature ranges is discussed in detail. L.Bovey

535.338.333

9073. HYPERFINE STRUCTURE OF THE FORBIDDEN Cd I LINE λ3141 A.U. ($5s^2\ {}^1S_0 - 5s5p\ {}^3P_2^0$). F.Leś and H.Niewodniczański.
Bull. Acad. Polon. Sci. Cl.3, Vol. 5, No. 3, 299-303 (1957).

Bowen (Rev. Mod. Phys. Vol. 8, 58, 1936) suggested that strictly forbidden transitions may occur when the nuclear spin is not zero. For Cd, odd isotopes have spin ½ and even spin 0; thus only odd isotopes should emit this line which should be single (F, 3/2 → 1/2). But if the even isotopes also emit a single component the line will be double. Examination with a Fabry-Perot interferometer shows the line to be single, confirming the theory.
G.F.Lothian

535.34.07

9074. INFRARED SPECTROSCOPY FROM 5 TO 200 MICRONS WITH A SMALL GRATING SPECTROMETER.
R.C.Lord and T.K.McCubbin, Jr.
J. Opt. Soc. Amer., Vol. 47, No. 8, 689-97 (Aug., 1957).

For previous work in the 3-5 micron range, see Abstr. 6888 (1955). In the range 5-50 microns the achieved resolution was about 0.3 cm^{-1} or slightly better. Beyond 50 microns the resolution varied from 0.5 to 1.0 cm^{-1}. No predispersive device was used, but filters, residual-ray reflections, selective chopping of radiation, and "off-blaze" use of the doubly passed gratings were employed to remove higher orders from the spectra. These devices are discussed briefly and their characteristics for the various spectral regions have been tabulated. Calibration has been carried out with higher orders of atomic emission lines and absorption lines of previously measured molecular spectra. Wave-number precision is estimated as about 0.04-0.05 cm^{-1} in most spectral regions. Performance of the spectrometers is illustrated by reproductions of the actual recorded spectra of water vapour at 1600, 300, and 200-55 cm^{-1}, of ethylene and ammonia at 950 cm^{-1}, of benzene at 673 cm^{-1}, and of carbon disulphide at 400 cm^{-1}. A.

535.343 : 535.37

9075. CONTRIBUTION TO THE THEORY OF ABSORPTION AND LUMINESCENCE SPECTRA OF SOLUTIONS. COMPARISON OF CALCULATED SHAPE OF ABSORPTION AND LUMINESCENCE BANDS WITH EXPERIMENTAL DATA. A.F.Lubchenko.
Optika i Spektrosk., Vol. 2, No. 2, 195-203 (1957). In Russian.

A theory is developed for symmetrical and non-symmetrical absorption curves and expressions are given for lifetimes of impurity centres in excited states. A comparison is made with experimental results for $CaSiO_3$: Mn : Pb (5.6 molar % Mn) at 400°C and 250°C, ruby at 550°C and −190°C, and anthracene at −180°C.
L.Bovey

535.343 : 535.37 : 535.39

9076. STUDY OF THE ABSORPTION, REFLECTION AND EMISSION SPECTRA OF A VERY THIN LAYER OF CuBr AT 4.2°K.
S.Nikitine and R.Reiss.
C.R. Acad. Sci. (Paris), Vol. 245, No. 1, 52-4 (July 1, 1957). In French.

A layer of thickness 0.4μ was produced by evaporation. Absorption bands occurred from 4160 to 4188 A and from 3960 to 3997 A. In the range of the first band strong selective reflections were observed at 4161, 4178 and 4187 A. The luminescence spectrum, studied at both 4.2°K and 77°K, contained lines at 4199, 4230 and 4223 A. The spectra are attributed to transitions involving exciton levels or surface states. B.T.M.Willis

535.343 : 536.424

9077. SPECTROSCOPIC OBSERVATION OF A DISCONTINUOUS CHANGE OF PHASE AND OF A TEMPERING PHENOMENON IN POTASSIUM CHROME ALUM. L.Couture.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 515-17 (July 29, 1957). In French.

The absorption line at 14 860 cm^{-1} shows a discontinuous change of position and width on cooling slowly through 60°K, indicating a change of phase at this temperature. On rapid cooling there is no discontinuity and the crystal remains indefinitely in a metastable state. G.F.Lothian

535.343 : 535.37

9078. LUMINESCENCE OF SOME "PURE" SALTS.
V.A.Arkhangel'skaya and P.P.Feofilov.
Optika i Spektrosk., Vol. 2, No. 1, 107-15 (1957). In Russian.

The absorption and luminescent spectra of HgI_2, PbI_2, AgI, CdS (hexagonal form), ZnS (cubic and hexagonal) were observed. A diffraction-grating instrument (6.5 A/mm) and a quartz-prism spectrograph were used. The samples were purified in various ways: deposition from solutions, vacuum sublimation and fusion. In general the spectra at low temperatures consist of five bands (nearly coinciding with the absorption lines) in the short-wave region and wider bands at longer wavelengths. Dependence of band intensity on temperature and intensity of source were investigated. L.Bovey

535.343

9079. DEPENDENCE OF SPECTRAL ABSORPTION IN CRYSTALS OF SILVER BROMIDE ON TEMPERATURE.
S.G.Grenishin and A.A.Solodovnikov.
Zh. tekh. Fiz., Vol. 27, No. 2, 262-8 (1957). In Russian.

It is shown experimentally that when such crystals are heated from room temperature to the melting point, the true edge of the absorption band is displaced towards the long-wavelength region of the spectrum. This displacement, for an absorption coefficient K = 50 mm^{-1} in the temperature range from 0-400°C is of the order of 0.16 mμ/degree. The introduction of AgS or CdBr as impurities in concentrations from 0.01 to 10 mol.% has little effect on the process. An analogy is found between the nature of the temperature dependence of the absorption edge and the temperature dependence of ionic conduction in AgBr. W.Bardsley

535.343 : 535.37

9080. ABSORPTION AND LUMINESCENCE OF BENZENE AND DEUTEROBENZENE CRYSTALS AT 20°K.
A.Zmerli, H.Poulet and P.Pesteil.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 517-20 (July 29, 1957). In French.

535.343 : 539.133

9081. VIBRATIONAL SPECTRUM AND STRUCTURE OF METAL-CYANIDE COMPLEXES IN THE SOLID STATE. II. $KAu(CN)_2$.
L.H.Jones.
J. chem. Phys., Vol. 27, No. 2, 468-72 (Aug., 1957).

For Pt I see Abstr. 7746 (1957). The infrared spectra of solid $KAu(CN)_2$ and the mono- and di-substituted C^{13} and N^{15} species were observed. The seven fundamental vibrations of the linear, symmetrical $Au(CN)_2^-$ ion have been assigned at 2160, 452, 2141, 427, 305, 368, and 100 cm^{-1}. From the observed frequencies of the normal and isotopic species, force constants are calculated for two possible structures: N−C−Au−C−N and C−N−Au−N−C. It is shown that the latter structure gives unreasonably large values for the CN stretching force constant and the CN, AuN interaction constant, and that therefore the cyanides are most likely bound to the gold through the carbon atoms. A.

535.343 : 539.133

9082. VIBRATIONAL SPECTRUM AND STRUCTURE OF METAL-CYANIDE COMPLEXES IN THE SOLID STATE. III. $Hg(CN)_2$.
L.H.Jones.
J. chem. Phys., Vol. 27, No. 3, 665-8 (Sept., 1957).

The infrared spectra of solid $Hg(CN)_2$ and the mono- and di-substituted C^{13} and N^{15} species were observed. The polarized spectrum of a single crystal of the normal species was also observed. The seven fundamental vibrations of the linear, symmetric $Hg(CN)_2$ molecule have been assigned at 2192, 415, 2193.5, 442, 276, 341, and ~100 cm^{-1}. From the observed frequencies of the normal and isotopic species, force constants are calculated for two possible structures: N−C−Hg−C−N and C−N−Hg−N−C. It is shown that the latter structure gives unreasonably large values for the CN stretching force constant (>20 md/A) and the CN, HgN interaction constant (~2.4 md/A), while the former structure yields quite reasonable force constants, namely: $F_{CN} = 17.6$, $F_{HgC} = 2.61$, $F_{CN,C'N'} = -0.1$, $F_{HgC,HgC'} = 0.1$, and $F_{HgC,CN} = 0.1$ md/A. These results are presented as strong evidence that the cyanides are bound to the mercury through carbon atoms. A.

535.343 : 548.7

9083. ABSORPTION OF LIGHT BY CRYSTALS OF CdS. V.L.Broude, V.V.Eremenko and É.I.Rashba.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 3, 520-3 (1957). In Russian.

Crystals grown by various techniques were studied at 20.4°K by polarized light. Near the continuous absorption region some 10 narrow bands were observed (20 400 - 20 600 cm^{-1}, see Abstr. 6041/1955). Their intensity varied from crystal to crystal, and from point to point in a given crystal. Two were not polarized and appeared due to surface effects; the remainder were ascribed not to excitonic phenomena (see Abstr. 5346/1957) but to interactions with impurities or lattice defects. This view appeared theoretically supported by the luminescence spectrum of a thin crystal which, at 20.4°K, showed bands corresponding to 6 of the 8 polarized absorption bands. C.H.L.Goodman

535.343

9084. ABSORPTION SPECTRUM OF KH_2PO_4 IN THE REGION OF THE VALENCY VIBRATIONS OF THE HYDROXYL. A.N.Lazarev.
Zh. tekh. Fiz., Vol. 27, No. 2, 426-7 (1957). In Russian.

Presents the results of an experimental study on the hydroxyl-vibration band in the spectrum of KH_2PO_4, the specimens being transparent disks pressed from KBr containing 0.25-0.5% KH_2PO_4. Two shallow minima at 2825 and 2445 cm^{-1} were found. These results, in conjunction with those of Landsberg and Barȳshanskaya (Dokl. Akad. Nauk SSSR, Vol. 61, 1027, 1948) and Narayanan (Proc. Indian Acad. Sci. A, Vol. 33, 240, 1951), dealing with Raman spectra, leave open the question of the two OH bands in the Raman spectrum of KH_2PO_4 being due to the tunnel effect of the proton (cf. Abstr. 10390/1954). F.Lachman

535.343

9085. INFRARED SPECTRA OF SOME NITRILOXIDES. S.Califano, R.Moccia, R.Scarpati and G.Speroni.
J. chem. Phys., Vol. 26, No. 6, 1777-8 (June, 1957).

Spectra have been recorded for the first time of sp aromatic nitrile oxides. The frequency assigned to the C≡N group (2300 cm^{-1}) corresponds to the CN stretching vibration in aromatic nitriles (2200 cm^{-1}) but shifted due to coupling with the NO vibration. The frequency assigned to N → O accords with the bond character. R.C.Seymour

535.343 : 535.375.5

9086. INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHYLENES. VIII. 1,1-DIFLUORO-2-BROMOETHYLENE. R.Theimer and J.R.Nielsen.
J. chem. Phys., Vol. 27, No. 1, 264-8 (July, 1957).

For previous work see Abstr. 1075 (1956). The infrared absorption spectrum of gaseous CF_2:CHBr was obtained with a double-pass spectrometer equipped with LiF, NaCl, and CsBr prisms. The Raman spectra of the compound in the gaseous and liquid states were photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. The 12 fundamental vibrational wave-numbers are assigned, as follows: Species a' : 3135, 1732, 1317, 1172, 957, 768, 568, 366, and 164 cm^{-1}; species a'' : 741, 583, and 227 cm^{-1}. Except for the lowest a' fundamental, all are for the gaseous state. The observed spectra are interpreted in detail. Thermodynamic properties for the ideal-gaseous state at 1 atm are calculated for six temperatures. A.

535.343

9087. MOLECULAR SPECTROSCOPY OF OXYGEN BY MEANS OF MICROWAVES. THE SHAPE OF THE ABSORPTION LINES. N.Carrara.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1593-608 (1956). In Italian.

535.343 : 539.133

9088. MICROWAVE SPECTRUM AND STRUCTURE OF $(CH_3)_3$ CCN. T.Sparstad and E.Amble.
J. chem. Phys., Vol. 27, No. 1, 317 (July, 1957).

The frequencies, measured on a Stark-modulated spectrometer were found, within error of measurement, to be consistent with the following rigid rotator model: C–H = 1.110 A; H_3C–C = 1.540 A; C–CN = 1.460 A; C–N = 1.158 A (all angles tetrahedral). R.W.Nicholls

535.343.9 : 535.375.54

9089. RAMAN SPECTRA OF VITREOUS BODIES AT HIGH TEMPERATURE. M.Harrand.
Ann. Phys. (Paris), Ser. 13, Vol. 2, No. 5-6, 309-17 (May-June, 1957). In French.

Measurements on silica at 725°C show the increased intensity expected from the theory of Placzek. B_2O_3 shows at all temperatures a narrow line at 808 cm^{-1}; at 600°C, above the melting point, and at 300°C, supercooled liquid of small viscosity, the spectra are identical and the line is strongly polarized. At room temperature the vitreous state shows the line completely depolarized. G.F.Lothian

535.343.9 : 535.375.56

9090. HIGH RESOLUTION RAMAN SPECTROSCOPY OF GASES. IX. SPECTRA OF H_2, HD, AND D_2. B.P.Stoicheff.
Canad. J. Phys., Vol. 35, No. 6, 730-41 (June, 1957).

For Pt VIII, see Abstr. 7779 (1957). The pure rotational lines and the Q branch lines of the 1-0 vibrational bands of H_2, HD, and D_2 have been photographed with a 21 ft grating spectrograph. From these spectra, a complete set of constants for the v = 0 and 1 levels of all three molecules have been determined. When these constants are combined with Herzberg's results of the forbidden infrared spectra of H_2 and HD they lead to improved values of the electronic ground-state constants of H_2 and HD. The leading terms in the Dunham power series expansion of the potential are calculated for H_2 and HD and are found to be mutually consistent. The isotopic relations are obeyed within experimental accuracy, and the small constants D_e, B_e, and H_e are in agreement with values given by theoretical formulae. A.

535.343.9 : 535.375.56

9091. HIGH RESOLUTION RAMAN SPECTROSCOPY OF GASES. X. ROTATIONAL SPECTRUM OF BUTATRIENE (H_2C=C=C=CH_2). B.P.Stoicheff.
Canad. J. Phys., Vol. 35, No. 8, 837-41 (Aug., 1957).

The rotational Raman spectrum of butatriene (H_2C=C=C=CH_2) at a pressure of 2 cm Hg was photographed with a 21 ft grating spectrograph. An analysis of this spectrum (based on the symmetric top approximation) yields the rotational constant $\frac{1}{2}(B_0+C_0)$ = = 0.1314$_1$ ± 0.0001 cm^{-1}. If the two outer C=C bonds in butatriene are assumed to have the same length as the C=C bonds in allene, namely 1.309 A, it is found that the central C=C bond has a length of 1.284 ± 0.006 A, a value which is shorter than that of the C=C bonds in ethylene and in allene. A.

535.345 : 539.234

9092. THE OPTICAL DENSITY AND THICKNESS OF EVAPORATED CARBON FILMS. A.Cosslett and V.E.Cosslett.
Brit. J. appl. Phys., Vol. 8, No. 9, 374-6 (Sept., 1957).

Measurements of the variation in optical density with thickness of evaporated carbon films (50-1500 A thick) give a value of the absorption coefficient considerably lower than that recently found by Agar (Abstr. 6924/1957). The mean value is close to that for natural graphite and electron diffraction patterns suggest that the films consist of randomly orientated graphite lamellae of varying width embedded in a variable amount of amorphous carbon. The optical density of films of the same nominal thickness may vary as much as 25%, probably due to variations in the degree of orientation of the lamellae and in their lateral extension. The much greater difference (60%) between these films and those of Agar is ascribable to more radical differences in the method of evaporating and collecting the carbon. This dependence of optical properties on method of preparation means that there can be no universally valid calibration curve for finding film thickness from optical density. The method proposed by Agar is reliable only if the details of preparation are standardized and a calibration curve is produced for each set of conditions. A.

535.345 : 539.132

9093. SINGLET–TRIPLET ABSORPTION IN BIACETYL SOLUTIONS. L.S.Forster.
J. chem. Phys., Vol. 26, No. 6, 1761-2 (June, 1957).

The effect of solvents on the intensity and wavelength of the singlet–triplet transition in biacetyl is discussed. R.C.Seymour

535.347

9094. ON THE DICHROISM OF THE LINE SPECTRUM OF VERY THIN SINGLE CRYSTALS OF RED HgI_2 AT VERY LOW TEMPERATURES M.Sieskind and S.Nikitine.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 659-661 (Aug. 5, 1957). In French.

Measurements down to 1.5°K confirm the authors' previous findings (see Abstr. 6024/1955) but not those of Gross and Kaplianskiĭ (Izv. Akad. Nauk SSSR, Ser fiz., Vol. 21, 220, 1957). G.F.Lothian

535.37

9095. YIELD OF PHOTOLUMINESCENCE OF SOLUTIONS. A.Jabłoński.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 5, 513-17 (1957).

A general theoretical expression is derived for the photoluminescence yield of a multi-component solution. Using the author's model of a luminescent centre, an equation is obtained for the relative yield as a function of the concentration of quencher molecules, which agrees well with published experimental data. Förster's theory, which is outlined, gives similar agreement. J.B.Birks

535.37

9096. ACTIVATOR SYSTEMS IN ZINC SULFIDE PHOSPHORS. J.S.Prener and F.E.Williams.
J. Electrochem. Soc., Vol. 103, No. 6, 342-6 (June, 1956).

Zinc sulphide containing copper at random zinc sites was prepared by radioactive decay of Zn^{65}. Measurements indicate that the isolated copper impurities do not contribute to luminescent emission. Using a covalent model of zinc sulphide, and recognizing the acceptor–donor nature of activators and coactivators, association of these impurities is found and the luminescent centre is identified as second or third nearest neighbour associated activator–coactivator pairs. The nearest neighbour pairs are transparent to 3650 A radiation and have many of the characteristics necessary to account for edge emission. A.

535.37

9097. OPTICAL PROPERTIES OF URANIUM HEXAFLUORIDE. II. PHOTOLUMINESCENCE AND ITS TEMPERATURE DEPENDENCE. G.D.Sheremet'ev.
Optika i Spektrosk., Vol. 2, No. 1, 99-107 (1957). In Russian.

For Pt I, see Abstr. 4146 (1957). Twenty bands were obtained in the region 4040-4870 A when solid UF_6 at 88°K was irradiated with Hg light (3650 and 3470 A). The strongest band occurred at 4167 A. Measurement of their structure gave an average interval of 200 cm^{-1} which agrees with one of the frequencies found in the study of fundamental vibrations. The frequency of a pure electronic transition occurs at about 24540 cm^{-1}. The decrease of luminescence intensity as the temperature was increased is quantitatively explained as a decrease in the lifetime of excited states. L.Bovey

535.37

9098. KINETICS OF INFRARED LUMINESCENCE OF CUPROUS OXIDE. I. EXPERIMENTAL.
N.A.Tolstoĭ, N.N.Tkachuk and R.K.Preobrazhenskiĭ.
Optika i Spektrosk., Vol. 2, No. 1, 116-26 (1957). In Russian.

The electronic equipment associated with a Kerr cell and the light-recording apparatus are described in detail. Measurements of the relaxation times (τ) were made at temperatures between −180° C and +50° C for samples prepared under different conditions with various amounts of excess oxygen. Excess oxygen increases τ, except at −180° C, and the maximum τ is obtained at low temperatures. Anomalies in the luminescence yield were also noted. L.Bovey

535.37

9099. KINETICS OF INFRARED LUMINESCENCE OF CUPROUS OXIDE. II. THEORETICAL INTERPRETATION. N.A.Tolstoĭ.
Optika i Spektrosk., Vol. 2, No. 2, 210-19 (1957). In Russian.

Three possible interpretations are given for the increase with temperature of the luminescence relaxation time in Cu_2O. These are: (1) the influence of temperature on increased mobility, (2) the influence of "the thermal barrier" and (3) exciton mechanism for luminescence. The last seems most probable from comparison of theory with experimental data. L.Bovey

535.37

9100. NEW METHODS OF INVESTIGATING RELAXATION PROCESSES AND TRAPPING CENTRES IN CRYSTAL PHOSPHORS. Ch.B.Lushchik.
Optika i Spektrosk., Vol. 2, No. 2, 220-8 (1957). In Russian.

The development of modified techniques of thermal bleaching and (thermo-)optically stimulated luminescence is discussed, largely in connection with alkali halide phosphors (see Abstr. 7021/1956). For example special heating regimes in combination with quenching allow the "freezing in" of trapped-carrier distributions corresponding to any desired temperature at a much lower temperature, enabling the appropriate optical absorption spectrum to be examined at leisure, or the stimulated luminescence to be studied in the absence of quenching effects. Extensive references are given. C.H.L.Goodman

535.37 : 548.7

9101. ON THE STABILITY OF F-CENTRES IN NaCl:Ni PHOSPHOR. E.I.Shuraleva.
Optika i Spektrosk., Vol. 2, No. 3, 396-9 (1957). In Russian.

Optical and thermal bleaching (O and T) of F-centres produced in NaCl and NaCl:Ni by X-rays were studied. Ni could be introduced during high temperature electrolysis (580-760°C). The O content was least in untreated crystals, increased after electrolysis, and was greatest in Ni-activated material (increasing with Ni content); it was decreased with increase in X-irradiation temperature. Similar behaviour was found with T. Changes in Ni concentration affected the time dependences of F-centre concentration and of the associated light-sum in relation to each other. The importance of a defect-free lattice for F-centre stability is emphasized. The possibilities of concentration quenching effects is briefly mentioned. C.H.L.Goodman

535.371 : 539.13

9102. TEMPERATURE DEPENDENCE OF ENERGY TRANSFER IN DIPHENYL–ANTHRACENE SYSTEM. H.N.Bose and M.L.Bhaumik.
J. chem. Phys., Vol. 26, No. 6, 1757-8 (June, 1957).

The ratio of the excitation energy retained by diphenyl to that transferred to anthracene was determined at temperatures between 83°K and 303°K for concentrations of 0.01%, 0.1%, and 1% anthracene. The energy transfer process becomes dependent on temperature only when some of the diphenyl molecules are separated from the nearest anthracene molecules by more than 25 ± 5 A. G.I.W.Llewelyn

535.371

9103. A NEW LUMINESCENCE EMISSION IN Cu_2O. J.Bloem, A.J.van der Houven van Oordt and F.A.Kröger.
Physica, Vol. 22, No. 12, 1254-6 (Dec., 1956).

The spectral distributions of transmission and luminescence were measured at 20°K and 70°K on polycrystalline Cu_2O samples prepared under partial pressures of O_2 between 10^{-4} and 30 mm. At 20°K, samples prepared under O_2 pressures below 0.1 mm, showed an emission doublet with peaks at 0.72 μ and 0.82 μ and an absorption band at 0.64 μ, in addition to an emission doublet at about 1 μ. J.Franks

535.376

9104. INFRARED QUENCHING OF ELECTROLUMINESCENCE. H.Heckscher.
J. Opt. Soc. Amer., Vol. 47, No. 8, 765 (Aug., 1957).

Evidence for the effect is given. S.T.Henderson

535.39

9105. A REPRESENTATION OF THE OPTICAL CHARACTERISTICS OF ABSORBING MEDIA IN THE INFRARED REGION ON THE BASIS OF A MODEL OF A RESONATOR WITH VISCOUS FRICTION. I. METHOD. L.D.Kislovskiĭ.
Optika i Spektrosk., Vol. 1, No. 5, 672-84 (1956). In Russian.

The paper attempts to give an account of the infrared spectra of solids possessing strong continuous absorption bands. A classical model of a resonator with viscous friction is adopted and a resonance curve drawn for it. The optical constants n and k may determine graphically from the curve. Assuming a correspondence between reflection and the amplitude and phase of forced oscillations a method is suggested of constructing a reflection spectrum curve. A combination of the author's method and that of Robinson and Bode enables precise determination to be made of the phase of forced vibrations. C.R.S.Manders

535.39

9106. A REPRESENTATION OF THE OPTICAL CHARACTERISTICS OF ABSORBING MEDIA IN THE INFRARED REGION ON THE BASIS OF A MODEL OF A RESONATOR WITH VISCOUS FRICTION. II. ALKALI HALIDE CRYSTALS. L.D.Kislovskiĭ.
Optika i Spektrosk., Vol. 2, No. 2, 186-94 (1957). In Russian.

The paper is a sequel to the work described in the preceding abstract. The model is applied to the problem of dispersion, and to other optical characteristics in alkali halide crystals in the infrared region. Conditions are worked out for which a wavelength of maximum absorption appears in the dispersion formula. Using a combination of his own methods and those of Roberts (Abstr. 4470/1950) the author uses the properties of the ions to determine optical characteristics of crystals. C.R.S.Manders

535.39 : 535.323

9107. CALCULATION OF A THIN MULTILAYER PLATE AS A ONE-LAYER PLATE WITH AN EFFECTIVE REFRACTIVE INDEX. A.A.Basil'kovskiĭ.
Optika i Spektrosk., Vol. 2, No. 2, 229-35 (1957). In Russian.

When the wavelength (λ) of radiation falling on a multilayer plate is greater than the individual layer thickness (h), the plate's optical properties can be calculated by a formula for an equivalently thick single plate. In this formula an effective refractive index n_{eff} is used, where

$$n_{eff} = \frac{(n_1^2 + n_2^2 + n_3^2 + \ldots + n_q^2)}{q^2}$$

and n_1, n_2 ... n_q are the refractive indices of each layer. The precision of the calculations by this simplified formula increases as h/λ decreases and varies from about 10% to 2.5% for h/λ equal to 10^{-2} and 3×10^{-3} respectively. L.Bovey

535.39 : 548.52

9108. REFLECTION OF LIGHT FROM A LIQUID SURFACE AND ITS CONNECTION WITH THE PROCESS OF CRYSTALLIZATION. V.A.Kizel' and A.F.Stepanov.
Optika i Spektrosk., Vol. 2, No. 2, 263-8 (1957). In Russian.

The relationship between the ellipticity of reflected light and the temperature near the crystallization point of 28 liquids is investigated. The functional connection of this relationship with the nature of the crystallization process is shown. A type of precrystallization is postulated and a phase transition of a second kind has been noticed on the surface. L.Bovey

535.391

9109. ANALYTICAL THEORY OF OPTICAL PROPERTIES OF MULTILAYER DIELECTRIC COATINGS. P.G.Kard.
Optika i Spektrosk., Vol. 2, No. 2, 236-44 (1957). In Russian.

New formulae are given for the calculation of the reflection and transmission of light in these coatings and possible application to anti-reflection surfaces considered. L.Bovey

535.391

9110. A THEORY OF TRANSLUCENT MULTILAYER COATINGS. P.G.Kard.
Optika i Spektrosk., Vol. 2, No. 2, 245-53 (1957). In Russian.

On the basis of previous work (see preceding abstract) a new graphical method is given for calculation of optimum conditions in 2, 3, or 4-layer deposits. L.Bovey

535.392

9111. TWO-LAYER ANTI-REFLECTION COATINGS FOR GLASS IN THE NEAR INFRA-RED. J.T.Cox, G.Hass and R.F.Rowntree.
Vacuum, Vol. 4, No. 4, 445-55 (Oct., 1954; publ. June, 1957).

Three types of two-layer anti-reflection coatings capable of producing zero reflectance on glass of index 1.51 are discussed. All three types consist of a high-index inner film and a low-index outer film and use the same low-index film material (MgF_2 with $n_1 = 1.38$) but various high-index coatings. The first design consisting of two quarter-wave films requires $n_2 = 1.7$ for producing zero reflectance on glass at 1 μ wavelength. The reflectance minimum of such double quarter-wave coatings is extremely sensitive to thickness variation of the low-index film and very much less influenced by mismatching of the high-index coating. The second type of coating consists of a thin high-index ($t_2 < \lambda/4$) and a thick low-index ($t_1 < \lambda/4$) film. This combination can yield zero reflectance for all values of $n_2 > 1.7$. The third coating type uses one half-wave and one quarter-wave film. With coatings of this type two reflection minima which become zero for $n_2 = 1.9$ can be obtained. Experimental coatings of the three types were used for anti-reflecting glass in the near infrared. The coatings were prepared by high vacuum evaporation of magnesium fluoride, silicon monoxide and cerium dioxide. A.

535.393 : 535.312

9112. THE SPECTRAL REFLECTIVITY OF BACK-SURFACE AND FRONT-SURFACE ALUMINIZED MIRRORS. G.G.Twidle.
Brit. J. appl. Phys., Vol. 8, No. 8, 337-9 (Aug., 1957).

Results are given of a determination of spectral reflectivity of back- and front-aluminized quartz mirrors in the wavelength-range 0.25-1.35 μ. A resume is given, including reference to other recent work on front-surface mirrors, showing what are thought to be the highest values of reflectivity obtainable over the range 0.1-12 μ. The technical precautions necessary for the attainment of the optimum values are discussed in practical terms. A.

535.393 : 539.23

9113. CALCULATION OF THE AMPLITUDE OF A PLANE WAVE REFLECTED FROM A HOMOGENEOUS, PARALLEL-SIDED METAL LAYER. P.Dumontet.
C.R. Acad. Sci. (Paris), Vol. 244, No. 17, 2234-6 (April 24, 1957). In French.

The calculation is made for a monochromatic, normally incident wave and takes into account the effect of the impact of the electrons on the walls of the layer. For the visible region and for metals such as Ag, Au, Al, the results are in close agreement with those obtained from classical theory. E.A.Mussett

535.417 : 531.715

9114. ERRORS IN THE MEASUREMENT OF OPTICAL THICKNESS OF A TRANSPARENT ISOTROPIC PLATE BY DIFFERENTIAL INTERFEROMETRY. G.Gontier.
C.R. Acad. Sci. (Paris), Vol. 244, No. 21, 2591-4 (May 20, 1957). In French.

The shearing interferometer comprises a polarizer, a Wollaston prism and a concave mirror; errors due to finite thickness of the prism and non-parallelism of the rays in it are discussed. W.Weinstein

535.417 : 533.6.011.5

9115. METHODS OF INTERFEROMETRY APPLIED TO THE VISUALIZATION OF FLOWS IN WIND TUNNELS. R.Chevalerias, Y.Latron and C.Veret.
J. Opt. Soc. Amer., Vol. 47, No. 8, 703-7 (Aug., 1957).

The optical methods for flow visualization in wind tunnels provide an interesting means of analysis. In order to extend their use, in transonic and supersonic flows, it is necessary to obtain photographs and high-speed pictures and a quantitative interpretation must must be possible. Two types of equipment utilized are described. One of them is an interferometer of the horizontal Mach type. The other, called "interferential schlieren" apparatus is the result of the application of the interferential contrast methods developed by Francon and Nomarski. In this paper two optical setups are described, the first for an over-all study of the flow over a model, the second for a detailed analysis of a small region. Photographs obtained with these devices show how interesting is the interferential schlieren apparatus which permits, in certain cases, a quantitative analysis as precise as that provided by separated beams interferometry, but with a simpler equipment which is easier to handle, less sensitive to external vibrations, and less expensive. A.

535.421

9116. THEORY OF THE ECHELETTE GRATING. S.G.Rautian.
Optika i Spektrosk., Vol. 2, No. 2, 279-80 (1957). In Russian.

In a recent paper Hatcher and Rohrbaugh (Abstr. 2013/1956) obtained a general expression for the intensity distribution of this instrument. It is pointed out that there are errors in that paper. S.Chomet

535.422 : 534.26 : 538.566

9117. DIFFRACTION OF A SPHERICAL WAVE PULSE BY A HALF-PLANE SCREEN. J.R.Wait.
Canad. J. Phys., Vol. 35, No. 5, 693-6 (May, 1957).

The structure of the diffracted wave is determined for a point source. A Fourier integral method is used. An expression containing several terms is obtained for the velocity potential, and the physical interpretation of the various terms is explained. L.S.Goddard

535.43 : 535.324 : 535.81

9118. RAYLEIGH SCATTERING IN OPTICAL GLASSES. L.Prod'homme.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 300-2 (July 17, 1957). In French.

Visual scattering measurements at λ 5461 A were made on 13 glasses. A functional dependence of scattering on refractive index was found with minor variations due to glasses of similar index but different compositions. W.Weinstein

535.514.3

9119. ON PRODUCTION OF POLARIZERS FOR THE ULTRA-VIOLET. Y.Bouriau and J.Lenoble.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 511-14 (July 29, 1957). In French.

A polarizing prism of Iceland spar cemented with "gédamine", a urea-formaldehyde resin dissolved in butyl alcohol, has been found satisfactory down to 2500 A. Transmission curves are given for other cements tried. G.F.Lothian

535.55

9120. EVALUATION OF THE PHOTOELASTIC COEFFICIENT IN THE CASE OF POLYMERS. Yu.Ya.Gotlib.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 1, 57-60 (1957). In Russian.

The paper carries out a systematic mathematical discussion to show that the expression

$$B = \frac{\Delta n}{t} = \frac{2\pi(\bar{n}^2 + 2)^2 \Delta A}{27\bar{n}},$$

where $\Delta n = n_1 - n_2$; n_1 and n_2 are refractive indices for the light polarized parallel and at right angles to the deformation, respectively; $\bar{n} = \frac{1}{2}(n_1 + n_2)$; ΔA is the mean anisotropy of the polymer chain in the coordinate system linked with the chain, while t is the stress per unit section of the specimen, is suitable for any polydisperse Gaussian network formed by chains with inhibited internal rotation, the fluctuations of the internal nodes being taken into account.

F.Lachman

535.557

9121. POSITION OF THE OPTIC AXES IN A LIQUID SHOWING FLOW DOUBLE REFRACTION. H.G.Jerrard.
J. Opt. Soc. Amer., Vol. 47, No. 8, 765-6 (Aug., 1957).

A liquid is rendered optically biaxial when it is subjected to shear between two concentric cylinders by rotating one and keeping the other stationary. This note considers the position of the optic axes, with an illustration of the case when the liquid behaves as a negative biaxial crystal. It is pointed out that, in this work, it is usual to let the sign of the birefringence characterize the liquid irrespective of the crystallographic definition. H.G.Jerrard

535.58

9122. THE OPTICS OF MAGNETIC CRYSTALS. I. EQUATION OF NORMALS. F.I.Fedorov.
Optika i Spektrosk., Vol. 1, No. 7, 926-36 (1956). In Russian.

Theoretical paper. Deals with optical properties of homogeneous media possessing arbitrary electric and magnetic isotropies. Expressions are derived for the vectors of a plane-wave field and the conditions for binormals. C.R.S.Manders

535.58

9123. THE OPTICS OF MAGNETIC CRYSTALS. II. BINORMALS AND BIRADIALS. OPTICAL SURFACES. F.I.Fedorov.
Optika i Spektrosk., Vol. 2, No. 3, 361-70 (1957). In Russian.

Confirmation of previous work (see the preceding abstract). The directions of the binormals of a general magnetic crystal are determined and limits found between which values of the refractive index may lie. The cases of the bipolar normal optical surfaces and their cross-sections are considered for rhombic, monoclinic and triclinic magnetic crystals. Entirely theoretical.

C.R.S.Manders

535.58

9124. THE OPTICS OF MAGNETIC CRYSTALS. III. UNIAXIAL AND SINGLY-REFRACTING MAGNETIC CRYSTALS. F.I.Fedorov.
Optika i Spektrosk., Vol. 2, No. 4, 514-23 (1957). In Russian.

The propagation of a plane-polarized light wave in a singly refracting magnetic crystal is discussed. It is shown that the crystal's transparency must have directional properties related to its magnetic field. J.W.Gardner

535.581 : 538.612

9125. WAVELENGTH DISPERSION OF THE MAGNETIC BIREFRINGENCE OF COLLOIDAL FERRIC HYDROXIDE. M.T.Respaut.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 302-5 (July 17, 1957). In French.

The magnetic birefringence of Bravais iron is determined at three wavelengths: 6438 A, 5780 A, and 5460A for solutions of thicknesses 10, 5 and 2 mm and field strengths up to 15 000 gauss. The results are exhibited graphically and good agreement is found with the formula proposed by Servant (Abstr. 6419/1950, 3516/1952). H.G.Jerrard

535.6.08

9126. CHROMATIC SIGNIFICANCE OF SPECTROPHOTOMETRIC ERRORS. D.L.MacAdam.
J. Opt. Soc. Amer., Vol. 47, No. 8, 766 (Aug., 1957).

Random spectrophotometric errors lead to chromatic errors only about one third of those deduced from the error distribution assumed by Shipley and Walker (Abstr. 2094/1957). G.F.Lothian

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

HEAT 536

536.2.02

9127. PROPAGATION OF A THERMAL SHOCK IN A HOMOGENEOUS FINITE WALL: PASSAGE OF THE MAXIMUM. F.Camia.
C.R. Acad. Sci. (Paris), Vol. 244, No. 18, 2293-6 (April 29, 1957). In French.

From the equations and solutions given in Abstr. 7044/1957 numerical values for the time of passage and magnitude of the maximum temperature as a function of the thickness of the wall are obtained. The propagation within a wall of indefinite thickness can then be estimated. S.Weintroub

536.2.02

9128. PROPERTY OF THE DERIVATIVES AT THE ORIGIN OF BALLISTIC CURVES OF HEAT (AND OF DIFFUSION). F.Camia.
C.R. Acad. Sci. (Paris), Vol. 244, No. 24, 2897-8 (June 12, 1957). In French.

A quantity of heat is instantaneously emitted at time t = 0 from a point in a solid. If the temperature $\theta = f(t)$ at any other point is zero at t = 0, it is shown that the successive derivatives θ', θ'', ... $\theta^{(p)}$ with respect to t at t = 0 are also zero. The value of the very large number p can be specified precisely. S.Weintroub

536.2.02

9129. BALLISTIC CURVES OF HEAT (AND OF DIFFUSION) IN A HOLLOW OR SOLID SPHERE AND FOR THE CASE OF RADIAL FLUX. FUNDAMENTAL EQUATIONS. F.Camia.
C.R Acad. Sci. (Paris), Vol. 245, No. 2, 144-7 (July 8, 1957). In French.

A solution of the equation

$$\frac{\partial\theta}{\partial t} = \frac{h}{x}\frac{\partial^2(x\theta)}{\partial x^2}$$

in a form similar to a Fourier series is derived for the temperature θ at a point within the material of a hollow homogeneous sphere. From this the solutions applicable to a solid sphere and a finite wall are deduced. S.Weintroub

536.2.02

9130. ON THE GENERAL SOLUTION WITH BOUNDARY CONDITIONS OF THE [EQUATION OF] TRANSFER OF HEAT OR ELECTRICAL ENERGY. L.v.Szalay and K.H.Löcherer.
Frequenz, Vol. 11, No. 4, 97-106 (April, 1957). In German.

It is shown that the thermal conduction equation $\lambda\nabla^2 U = c\delta(\partial U/\partial t) - Q(r,t)$, where $U(r,t)$ is the temperature, λ, c, δ the thermal conductivity, specific heat and density respectively, all considered constant, and r, t the spatial coordinate and time, can be solved elegantly (for suitable boundary and initial conditions) by the transformation method of Picone and Amerio. Expressions for the solutions of the technically important cases of the rectangular parallelopiped, the cylinder and the sphere, are tabulated. S.Weintroub

536.21 : 536.413 : 537.323

9131. THERMAL AND THERMOELECTRIC PROPERTIES OF THE ALLOYS OF SILICON WITH THE TRANSITION METALS. P.V.Gel'd.
Zh. tekh. Fiz., Vol. 27, No. 1, 113-18 (1957). In Russian.

A brief review of work at the Ural Polytechnical Institute, Sverdlovsk, on pure Si and its alloys with Fe, Cr and Mn. Tables and graphs give the thermal conductivity, thermal expansion and thermoelectric power of alloys of these metals containing 0-98.8% Si and the variation of these quantities with temperature in the range 100-900° C. A.F.Brow

536.2

9132. ON THE REPRESENTATION OF THERMAL CONDUCTIVITIES OF GASEOUS BINARY MIXTURES. APPLICATION TO MIXTURES COMPOSED OF AIR AND CARBON DIOXIDE. A.Dognin.
C.R. Acad. Sci. (Paris), Vol. 244, No. 20, 2484-5 (May 13, 1957). In French.

The three relationships of Lindsay and Bromley (Abstr. 8689/

1950), Brokaw (Industr. engng. Chem., Vol. 47, No. 11, 2398, 1955), and the author (Abstr. 2114/1957), for the thermal conductivity of a mixture of two gases are shown to be equivalent in certain circumstances. Applied to the experimental results for the mixture of air and carbon dioxide the relationships agree within 1/500 at 40°C.

S.Weintroub

536.33.08 : 537.311.33

9133. GERMANIUM BOLOMETERS WITH LOW INERTIA.
V.N.Bogomolov, Yu.V.Ilisavskiĭ, M.Kornfel'd, L.S.Sochava and R.I.Strunin.
Zh. tekh. Fiz., Vol. 27, No. 1, 213-15 (1957). In Russian.

Description is given of a method for the preparation of germanium bolometer elements by evaporation in vacuo. The sensitive elements are about 1 mm square and have silver contacts. The resistance between contacts is 1-3 MΩ. The sensitivity is between 60 and 70 volts per watt input and the signal-to-noise ratio is about 4 times better than for similar sized thermal bolometers. The relaxation time is between 3 and 4 milliseconds. A drawing shows the construction.

A.F.Brown

536.413 : 537.226.2 : 537.228.2

THERMAL EXPANSION OF $Ba(Ti,Sn)O_3$. See Abstr. 8594

536.421.4 : 548.523

9134. SOLUTION OF THE PROBLEM OF THE SOLIDIFICATION OF A SPHERE, ALLOWING FOR THE CHANGE IN THE TEMPERATURE OF THE CRYSTALLIZATION FRONT DURING THE PROCESS OF SOLIDIFICATION. L.G. Kachurin.
Zh. tekh. Fiz., Vol. 27, No. 3, 543-7 (1957). In Russian.

The author assumes that the solidification begins at the surface of the sphere and spreads concentrically into the interior; he also accepts the recently made assumption that the crystal growth in a supercooled liquid is the result of the formation and subsequent growth of bidimensional crystal nuclei on crystal faces. The final equation obtained is

$$\tau = \int_0^R \frac{\rho L r(R - r)}{\lambda R[f(r) - T_1]}\,dr,$$

where τ is the time of the complete solidification of a sphere with the radius R and latent heat of melting L; ρ is the density of the substance in the solid phase; λ is the coefficient of heat conductivity of the solid substance; T_1 is the temperature of the surface of the sphere; $f(r) = T$ is the temperature of the front of crystallization, and r is its radius. This solution which allows for the difference between T and T_0 (temperature of the stable phase equilibrium) gives results which are more accurate than those obtained from the equation

$$\tau = \frac{\rho L R^2}{6\lambda(T_0 - T_1)}.$$

Both equations have been applied to the solidification of the supercooled drops of water.

F.Lachman

536.424.1

9135. NEW PHASE TRANSITION IN HI.
G.L.Hiebert and D.F.Hornig.
J. chem. Phys., Vol. 26, No. 6, 1762-3 (June, 1957).

Infrared absorption studies in the temperature range 6°-79°K indicate that the phase stable between 25°K and 70°K has an ordered structure different from those of HCl and HBr in their low temperature modifications. At 25°K HI undergoes transition to a phase (previously unreported) the structure of which either has more molecules in the primitive unit cell or a lower symmetry than in the phase stable above 25°K.

W.Good

536.431 : 537.566

9136. METHOD OF DETERMINING THE TURBULENT VELOCITY OF FLAME PROPAGATION. K.P.Vlasov.
Zh. tekh. Fiz., Vol. 27, No. 2, 338-44 (1957). In Russian.

This velocity (u_t) is defined as the velocity of the flame in the direction normal to the "macro" surface of burning; it depends on the properties of the flow, especially its turbulence. This definition is the cause of great difficulties in the experimental determination of u_t. The "macro" surface or, more accurately, the "mean" surface of the (very variable) flame can be found statistically from a sufficiently large population of momentary positions of the flame front; another, less accurate, method involves taking the means of the extreme positions. The author discusses the possible methods of determining the flame limits in a turbulent flow, i.e. measurements (a) with instruments characterized by a certain time lag, and (b) using lagless methods. Out of the more accurate latter methods those based on the ionization current in the flame are shown to be preferable to photographic methods (in their book "Investigations on the combustion process in engines", Mashgiz, 1949, Inozemtsev and Koshkin showed that the ionization commences simultaneously with the combustion; Aravin's thesis of 1952 proved that the ionization in the reaction zone of the flame is 10^5-10^7 times as great as the corresponding equilibrium ionization at the same temperature). The author suggests a method of determining the mean limits of the flame by measuring the ionization current, using either a stationary sensing element which is moved, step by step, towards the variable flame, or else by moving the sensing element very quickly through the flame, in which case the ionization current is recorded on an oscillogram.

F.Lachman

536.48

9137. LOW-TEMPERATURE PHYSICS IN THE U.S.S.R.
K.Mendelssohn.
Nature (London), Vol. 180, 460-2 (Sept. 7, 1957).

Report on a conference on low-temperature physics held in July 1957 at the Institute for Physical Problems of the U.S.S.R. Academy of Sciences, Moscow.

536.48

9138. QUANTIZED SURFACE WAVES IN SUPERFLUID HELIUM.
C.G.Kuper.
Physica, Vol. 22, No. 12, 1291-2 (Dec., 1956).

If E(k) is the energy spectrum of elementary excitations and k its wave-number, momentum transfer from a massive body is possible only if the relative velocity $< V_{crit} = E(k)/\hbar k$. For phonons and rotons this leads to far too large V_{crit}. Quantized surface excitation ("ripplons"), however, give $V_{crit} \cong (4g\sigma/\rho)^{1/4} \cong 10$ cm/sec (g = acceleration of gravity, σ = surface tension, ρ = density). This is of the order of magnitude of the critical velocity in a Rollin film. The Van der Waals forces responsible for the formation of the film introduce only a small modification to the expression for V_{crit}.

H.London

536.48

9139. THE HYDRODYNAMIC STABILITY OF HELIUM II BETWEEN ROTATING CYLINDERS. I.
S.Chandrasekhar and R.J.Donnelly.
Proc. Roy. Soc. A, Vol. 241, 9-28 (July 23, 1957).

This is investigated on two assumptions regarding the mutual friction force, F, between the normal and the superfluid components of the liquid. On both assumptions F is proportional to the constant vorticity which prevails in the stationary state and to the difference in the velocities between the two fluids; however, on one assumption the effect of F is confined entirely to the transverse plane, while on the other it is allowed to be isotropic (with respect to the difference in the velocities). The hydrodynamic problem is solved for the case when the two cylinders (of radii R_1 and R_2) are rotated in the same direction and $(R_2 - R_1) \ll \frac{1}{2}(R_2 + R_1)$. It follows from the theory that when $\partial(r^2\Omega)/\partial r < 0$ (where Ω denotes the angular velocity and r the distance from the axis) the flow becomes (eventually) unstable along two branches: the first of these is the normal (Taylor) instability of a viscous fluid inhibited by its coupling with an inviscid fluid, and the second is the (Rayleigh) instability of the superfluid inhibited, in turn, by its coupling with a viscous fluid. Further, in all cases the critical Taylor number of instability (suitably defined) becomes asymptotic to a relation which is equivalent to $\Gamma^2 = \frac{1}{2}(R_2^2 - R_1^2)/R_1^2$, where Γ is the coupling constant. From an experiment of Kolm and Herlin's (1956), to which the present theory appears applicable, a value of $\Gamma = 0.52$ is deduced; this is in very good accord with the value $\Gamma = 0.55$ which Hall and Vinen (1956) have deduced from an unrelated experiment.

A.

536.48

9140. THE HYDRODYNAMIC STABILITY OF HELIUM II BETWEEN ROTATING CYLINDERS. II. S.Chandrasekhar.
Proc. Roy. Soc. A, Vol. 241, 29-36 (July 23, 1957).

The characteristic value problems (preceding abstract) to which a study of the hydrodynamic stability of helium II between rotating cylinders leads one, are solved here correctly with respect to the boundary conditions which have to be satisfied. The nature and origin of the two types of instabilities which occur in this problem are further examined by considering the growth rate of small perturbations.

A.

536.631 : 537.312.62

9141. THE SPECIFIC HEAT OF THE SUPERCONDUCTORS Al, Sn AND V BELOW 1°K. B.B.Goodman.
C.R. Acad. Sci. (Paris), Vol. 244, No. 24, 2899-902 (June 12, 1957). In French.

Summarizes measurements on Al down to 0.2°K, and on Sn and V down to 0.4°K, which show that the electronic specific heat obeys an exponential law rather than a T^3 law. When plotted in reduced coordinates, however, the data for the three metals do not fall on the same curve, contrary to the hypothesis of a "law of corresponding states". R.G.Chambers

536.631

9142. LATTICE AND ELECTRONIC SPECIFIC HEATS OF COPPER AND SILVER. K.G.Ramanathan and T.M.Srinivasan.
J. sci. industr. Res., Vol. 16B, No. 7, 277-9 (July, 1957).

The variation of atomic heats of copper and silver have been investigated in the liquid helium range of temperature (4.2°-1.3°K). They can be represented by C_V (copper) = (1.728 ± 0.066) 10^{-4} T + (0.125 ± 0.002) $10^{-4}T^3$, and C_V (silver) = (1.471 ± 0.023) 10^{-4}T + (0.439 ± 0.003) $10^{-4}T^3$. A.

536.631 : 536.48

9143. THE SPECIFIC HEAT OF METALS AND ALLOYS AT LOW TEMPERATURES. H.Jones.
Proc. Roy. Soc. A, Vol. 240, 321-32 (June 11, 1957).

The effect of thermal excitation of the conduction electrons on the elastic shear constants is investigated in a metal in which the Fermi surface lies close to the Brillouin-zone boundaries. It is shown that in these circumstances electron-lattice interaction leads to an additional term in the specific heat, linear in the temperature in the liquid-helium range, which, therefore, augments the pure electronic specific heat. The variation in magnitude of this linear term is considered in the α-brasses. It is suggested that this is the physical effect underlying the peculiarities of the "electronic" specific heat of these alloys. A.

536.655

9144. ESTIMATION OF ENERGIES AND ENTROPIES OF VAPORIZATION. R.J.Marcus.
J. chem. Phys., Vol. 26, No. 6, 1765-6 (June, 1957).

This is done from a knowledge of the density and boiling point of the liquid. The formula used is derived by assuming a distribution law in which the ratio of the free volume in the liquid phase to that in the vapour phase is given by $\exp(-\Delta E_V/RT)$ where ΔE_V is the internal energy of vaporization. Good agreement is obtained between the calculated and observed energies. The agreement is less good for the entropies particularly in the case of imperfect liquids. W.Good

THERMODYNAMICS 536.7/.8

536.7

9145. FASHIONS IN THERMODYNAMICS. M.W.Zemansky.
Amer. J. Phys., Vol. 25, No. 6, 349-51 (Sept., 1957).

Some of the controversies in the nomenclature of thermodynamics are mentioned and some of the changing styles in thermodynamics are explained in terms of the thermocouple. Some unfortunate tendencies in the teaching of thermodynamics are deplored. A.

536.7 : 530.162

9146. IRREVERSIBLE GIBBSIAN ENSEMBLES.
J.L.Lebowitz and P.G.Bergmann.
Ann. Phys. (New York), Vol. 1, No. 1, 1-23 (April, 1957).

Continues the investigation of a model for the description of irreversible processes which was proposed in Abstr. 7928 (1955). This model permits the construction of Gibbs-type ensembles for open systems not in equilibrium. The internal dynamics of the system that is engaged in a nonequilibrium process is assumed to be described fully by its Hamiltonian. Its interaction with its surroundings, i.e. the driving reservoirs, is described in terms of impulsive interactions (collisions). The reservoirs themselves posses definite temperatures, are inexhaustible, and are free of internal gradients (i.e. they are temperature baths). The ensemble obeys an integro-differential equation in Γ-space, containing both the terms of the Liouville equation and a stochastic integral term that describes the collisions with the reservoirs. It is shown that, under very general assumptions, all distributions approach each other in the course of time. If there exists a stationary solution, it will be unique and will be approached asymptotically by every time-dependent solution. In general the stationary state does not represent thermodynamic equilibrium; the ensemble remains unchanged only because its surroundings maintain temperature gradients inside the thermodynamic system. Only if these surroundings are all at one temperature, i.e. if the system is in contact with but one reservoir, then the stationary state will correspond to the canonical distribution. As a result, the stochastic integral kernel that describes the effect of collisions with the reservoir will satisfy certain symmetry conditions. A detailed investigation of the micro-model shows that these conditions are indeed satisfied if the reservoir components are themselves in a canonical distribution prior to collision. In the presence of several reservoirs at slightly different temperatures, the Onsager reciprocal relations are satisfied by the stationary distribution. In this model the Onsager relations are thus obtained without an appeal to fluctuation theory, and without the assumption that detailed balancing holds for the elementary stochastic processes, i.e. for the interactions between system and reservoir. Finally, reservoirs are considered that maintain thermodynamic potentials in addition to the temperature, including chemical potentials. It turns out that the principal results are unaffected by this generalization. A.

536.7

9147. THERMODYNAMIC FUNCTIONS FOR SOME HALOGENATED METHYL CYANIDES. G.J.Janz and S.C.Wait, Jr.
J. chem. Phys., Vol. 26, No. 6, 1766-8 (June, 1957).

The statistical thermodynamic functions are calculated by well known methods using spectroscopic frequency assignments. W.Good

ELECTRICITY 537

537.13

9148. A NEW DETERMINATION OF THE GYROMAGNETIC RATIO OF THE PROTON. W.Wilhelmy.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 329-43 (1956). In German.

Measurement of the aqueous resonance frequency of protons relative to the frequency of Droitwich using a magnetic field of 100 gauss in the centre of a 1 m helix of accurately known dimensions and resistance and supplied with a known voltage leads to a value of 2.67556 ± 0.00008 × 10^4 sec^{-1} $gauss^{-1}$ for the proton gyromagnetic ratio, after applying the diamagnetic correction. This is 1 in 10^4 higher than the value, 2.67530 × 10^4 of Thomas, Driscoll and Hipple (Abstr. 6367/1949, 7441/1950). If accepted the new value requires the charge-to-mass ratio of the electron to be revised to 1.75908 × 10^7 e.m.u./g and the corresponding ratio for the proton to 9580.3 e.m.u./g. D.H.Whiffen

ELECTROSTATICS. DIELECTRICS 537.2

537.212 : 537.222

9149. ELECTROSTATIC FIELD OF A SQUARE-MESH WIRE GRID. B.Ya.Moĭzhes.
Zh. tekh. Fiz., Vol. 27, No. 1, 147-55 (1957). In Russian.

An approximate solution of the problem of the electrostatic condition of a grid made from thin intersecting cylindrical conductors (replaced for this case by charged filaments). An integral equation is developed for the density of charge on the filaments, and this equation is then expanded into a Fourier series; the regular infinite system of equations for the coefficients of the series is solved by the method of reduction. It is shown that, for thin conductors, the coefficients of the Fourier series vary (decrease) inversely as the numbers of harmonics; the equipotential surface of the approximate solution obtained coincides almost everywhere with the surface of the cylinders. F.Lachma

537.226.1 : 537.311

9150. THE ELECTRICAL CONDUCTIVITY AND PERMITTIVITY OF MIXTURES. D.A.de Vries; C.A.R.Pearce.
Brit. J. appl. Phys., Vol. 8, No. 7, 301, 301-2 (July, 1957).

This concerns two papers on the subject by Pearce (Abstr. 505 9627/1955). De Vries draws attention to his own work in which he reviewed the literature thoroughly and derived a general formula

very similar in form to an empirical expression proposed by Pearce. De Vries also gives a more detailed example from his work concerning spherical particles embedded in a continuous medium. Pearce, in reply, disputes the usefulness of the more general formula and also criticizes the particular example given by de Vries in some detail. K.W.Plessner

537.226.1 : 537.311.23 : 548.735

9151. ON A CONNECTION BETWEEN ELECTRICAL PROPERTIES OF CRYSTALS AND PARAMETERS OF THE CRYSTAL LATTICE. V.A.Presnov and V.I.Gaman.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 1, 67-9 (1957). In Russian.

Theoretical relationships are derived for (a) the breakdown field (b) the field at which departures from Ohm's law become observable. Both are functions of bond length, crystal energy and the masses of the constituent atoms. For nine alkali halides calculated and observed values of (a) are in fair agreement. C.H.L.Goodman

537.226.2 : 621.315.61

9152. DIGEST OF THE LITERATURE ON DIELECTRICS. VOLUME XVIII – 1954. Edited by H.M.Philofsky and R.W.Crowe. Washington: National Academy of Sciences – National Research Council Publication 383 (1955) 176 pp.

This annual volume is prepared by the Committee on Digest of Literature of the Conference on Electrical Insulation. Instrumentation and measurements, R.A.Soderman (1-21) 156 refs. Tables of dipole moments, dielectric constants and dielectric relaxation values, R.C.Miller and D.E.Williams (22-35, 36-53) 70 + 64 refs. Molecular and ionic interactions in dielectrics, J.Hart (54-68) 151 refs. Conduction phenomena in dielectrics, S.Roberts (69-82) 90 refs. The breakdown of dielectrics, A.H.Sharbaugh and R.W. Crowe (83-104) 102 refs. Ferroelectric and piezoelectric materials, W.R.Cook,Jr and H.Jaffe (105-17) 142 refs. Ferromagnetic materials, D.J.Epstein (118-31) 84 refs. Rubber and plastic insulation, L.I.Suber and S.Palinchak (132-47) 209 refs. Insulating films, H.A. Birdsall (148-56) 44 refs. Insulating liquids, J.E.Gibbons (157-67) 45 refs. Ceramic insulation, T.C.Browne and J.H.Strimple (168-76) 44 refs.

537.226.2 : 621.315.61

9153. DIGEST OF THE LITERATURE ON DIELECTRICS. VOLUME XIX – 1955. Edited by R.W.Crowe and J.D.Hoffman. Washington: National Academy of Sciences – National Research Council Publication 503 (1957) 236 pp.

This annual volume is prepared by the Committee on Digest of Literature of the Conference on Electrical Insulation. Instrumentation and measurements, R.A.Soderman (1-28) 191 refs. Table of dielectric constants and dipole moments, A.J.Petro (29-49) 98 refs. Molecular and ionic interactions in dielectrics, J.Hart (50-85) 255 refs. Conduction phenomena in dielectrics, S.Roberts (86-108) 140 refs. The breakdown of dielectrics, D.Berg and J.Kraitchman (109-45) 188 refs. Ferroelectric and piezoelectric materials, W.R.Cook, Jr and H.Jaffe (146-62) 194 refs. Ferromagnetic materials, B.A. Calhoun (163-83) 130 refs. Rubber and plastic insulation, S.Palinchak, C.W.Hamilton and L.L.Suber (184-208) 154 refs. Insulating films, H.A.Birdsall (209-20) 63 refs. Insulating liquids, J.E.Gibbons (221-32) 58 refs. Ceramic insulation, E.J.Smoke and S.Di Vita (233-6) 23 refs.

537.226.2

9154. DIELECTRIC CONSTANTS OF AMORPHOUS AND CRYSTALLINE SELENIUM AT 3.3 cm WAVELENGTH.
F.Eckart and H.Rabenhorst.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 381-93 (1956). In German.

The dielectric constant ϵ was measured by means of a cavity resonator for high-purity amorphous and polycrystalline selenium as functions of temperature from -30 to $+300^\circ$C and of bromine doping. For amorphous Se the value of ϵ fell from a room-temperature value of 6.3 to 6.6 as the temperature increased and after a minimum at the transition temperature rose again to the hexagonal modification value of $\epsilon = 8.4$ to 8.6. The bromine doping had little effect on the value of ϵ. C.A.Hogarth

537.226.2 : 537.311.32 : 538.221 : 621.315.612 : 621.318.12

9155. SOME NEW ELECTRICAL AND MAGNETIC CERAMICS.
G.Campbell.
J. sci. Instrum., Vol. 34, No. 9, 337-48 (Sept., 1957).

These materials have been conveniently classified as insulator, conductor, ferroelectric and ferromagnetic ceramics. The functions of insulator and of conductor ceramics are readily understood and the underlying theory of conduction is briefly outlined. The ferroelectric and ferromagnetic classes are less widely appreciated: the analogies and the differences in these groups are discussed. The wide range of applications for these materials is indicated and some ceramics of particular interest to the electrical engineer and physicist are described more fully. These include ferroelectrics based on barium titanate for ceramic capacitors, piezoelectric transducers, dielectric amplifiers and memory devices. Other important ceramics are ferromagnetics based on soft magnetic ferrites for radio and television components, very-high-frequency applications, magnetostrictive transducers, microwave components and memory devices together with ferromagnetics based on hard magnetic ferrites. Electronic devices and equipments of the future may use "solid" circuits made from various ceramic materials inert to moisture and capable of operating at relatively elevated temperatures. A.

537.226.2

9156. THE DIELECTRIC CONSTANT OF SiC.
D.Hofman, J.A.Lely and J.Volger.
Physica, Vol. 23, No. 3, 236 (March, 1957).

The low-frequency value of ϵ for very pure SiC crystals was measured at 20°K and 77°K. The asymptotic value of ϵ for the series is 10.2. C.A.Hogarth

537.226.2

9157. PHASE TRANSITIONS IN FERROELECTRIC SOLID SOLUTIONS BASED ON STRONTIUM PYROTANTALATE.
G.A.Smolenskiĭ, V.A.Isupov and A.I.Agranovskaya.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 4, 803-5 (1957). In Russian.

Curves are given for the dependence of permittivity at 500 kc/s on temperature in the following systems: (1) $Sr_2(Ta_{1-x},Nb_x)_2O_7$ for $x = 0$, 0.05, 0.10, 0.20 at temperatures between -150 and $+425^\circ$C; (2) $(Sr,Ba)_2Ta_2O_7$ at 9 concentrations between 0 and 25 mol.% Ba and at temperatures between -175 and $+275^\circ$C; (3) $(Sr_{1-x},Ca_x)_2Ta_2O_7$ for $x = 0$, 0.03, 0.06 and 0.09 at temperatures between -200 and $+200^\circ$C. The effect of composition on the shapes of the curves and on the Curie points is discussed. R.F.S.Hearmon

537.226.2

9158. NEW FERROELECTRICS AND ANTIFERROELECTRICS.
G.A.Smolenskiĭ
Uspekhi fiz. Nauk, Vol. 62, No. 1, 41-69 (1957). In Russian.

The author summarizes in systematic fashion the considerable volume of new material that has appeared in the last five years concerned with new materials. These are conveniently subdivided into two groups, the first having no hydrogen bond and the second group with such a bond. Substances in the first group are mainly of perovskite structure and include titanates, zirconates, mixed oxides, solid solutions of stannates, metaniobates and metatitanates, pyroniobates and pyrotitanates, tantalates and niobates of alkali metals, and the interesting case of WO_3 . Structural diagrams, graphs of dielectric permittivity v. temperature and a table of physical constants are given for each. Among H-bond materials discussed in similar fashion are dihydrophosphate of ammonia and its deutero-analogue, the dihydroarsenates of the alkali metals, Li–NH_4 and Li–Tl tartrates, guanadine–Al and methyl–Al sulphates, ammonium sulphate and double salts of langbeinite structure. Spontaneous polarization in crystals is also dealt with. 99 references (one quarter Soviet). C.R.S.Manders

537.226.2

9159. SOLID SOLUTIONS OF BARIUM METANIOBATE AND METATANTALATE IN BARIUM TITANATE, HAVING FERROELECTRIC PROPERTIES.
G.A.Smolenskiĭ, V.A.Isupov and A.I.Agranovskaya.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 5, 1053-6 (1957). In Russian.

Measurements were made of the dielectric constant (ϵ) and loss angle ($\tan\delta$) of $BaTiO_3$ with the addition of up to 10 mol.% of $BaNb_2O_6$ or $BaTa_2O_6$, as a function of temperature in the range -100° to $+200^\circ$C. From the form of the curves the cubic–tetragonal and tetragonal–orthorhombic transition temperatures are deduced. J.B.Arthur

537.228.1 : 537.226.2

9160. SOME CHARACTERISTICS OF THE PIEZOEFFECT IN BARIUM TITANATE UNDER STATIC CONDITIONS.
E.K.Dobrer and K.N.Karmen.
Zh. tekh. Fiz., Vol. 27, No. 3, 508-12 (1957). In Russian.

The dependence of polarization on stress in prepolarized barium titanate ceramics is determined both with and without a superimposed

electric field. The dependence on temperature of permittivity and polarization in stressed ceramics is also measured.

R.F.S.Hearmon

537.228.2

9161. SIMPLE EXPRESSIONS FOR THE TWO-DIMENSIONAL MAXWELL STRESS DISTRIBUTION IN IDEAL DIELECTRICS.
G.Power.
Amer. J. Phys., Vol. 25, No. 6, 344-6 (Sept., 1957).

By use of the complex variable, an attempt is made to obtain simple expressions for the Maxwell stress components in the case of two-dimensional electrostatic fields, when the dielectric material is homogeneous and effects of electrostriction can be neglected. Examples are given to illustrate how the results may be interpreted, with emphasis on the stress distribution at the interface separating two ideal dielectrics. A.

ELECTRIC CONDUCTION. CURRENTS 537.3

537.311.1 : 538.11

9162. ON SOME ELECTRICAL AND MAGNETIC PROPERTIES OF METALLIC SOLID SOLUTIONS. J.Friedel.
Canad. J. Phys., Vol. 34, No. 12A, 1190-211 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957). The resistivity, thermoelectric power, and magnetic susceptibility of metallic solid solutions at room temperature are reviewed, and their relation with the electronic structure emphasized. The special properties of transitional impurities are related to the emptying of their d shells. A.

537.311.1

9163. ON THE THEORY OF THE ELECTRICAL CONDUCTIVITY OF ANISOTROPIC INHOMOGENEOUS MEDIA. A.Nedoluha.
Z. Phys., Vol. 148, No. 2, 248-52 (1957). In German.

The general theory is derived and applied to the two special cases: (1) Small conductivity variations; (2) spherical particles, of low concentration, imbedded in the medium. R.Stratton

537.311.23 : 548.735 : 537.226.1

ELECTRICAL PROPERTIES OF CRYSTALS AND PARAMETERS OF THE CRYSTAL LATTICE. See Abstr. 9151

537.311.3 : 537.226.1

THE ELECTRICAL CONDUCTIVITY OF MIXTURES.
See Abstr. 9150

537.311.31 : 539.185.9

9164. THE EFFECT OF FAST-NEUTRON IRRADIATION AT LOW TEMPERATURES ON METALS WITH BODY-CENTRED CUBIC STRUCTURES. P.Lucasson.
C.R. Acad. Sci. (Paris), Vol. 245, No. 7, 796-9 (Aug. 12, 1957). In French.

Changes in electrical resistance of Nb, Ta and W wires were measured during irradiation in the Saclay reactor as a function of integrated flux. Isothermic annealing curves were obtained after the reactor was shut down. J.Adam

537.311.31 : 539.4.016 : 548.7

9165. INFLUENCE OF LATTICE DEFECTS ON THE ELECTRICAL PROPERTIES OF COLD-WORKED METALS.
H.G.van Bueren.
Philips Res. Rep., Vol. 12, No. 1, 1-45 (Feb., 1957).

Chapter I. A modern review of the principal physical properties of lattice imperfections in metals. The following properties of dislocations are described: (1) their energy and structure, (2) their movement and their multiplication under applied stress, and (3) forms of dislocation occurring in close-packed structures. A theoretical discussion of the scattering of the conduction electrons by dislocations is given and their influence on X-ray diffraction patterns is also described. The chapter concludes with a review of work on vacancies and interstitial atoms in metals, their energies of formation and movement (experiment and theory) and their influence on electrical resistivity. A.B.Lidiard

537.311.31 : 539.4.016 : 548.7

9166. INFLUENCE OF LATTICE DEFECTS ON THE ELECTRICAL PROPERTIES OF COLD-WORKED METALS.
H.G.van Bueren.
Philips Res. Rep., Vol. 12, No. 3, 190-239 (June, 1957).

Chapters II-V. By a consideration of the elementary processes which occur during plastic deformation, formulae are obtained for the densities of point defects (vacancies and interstitials) and for the total length of dislocation lines as functions of the induced strain. Increases in electrical resistivity have been observed in very pure Cu and Ag wires extended and twisted at liquid N_2 and liquid H_2 temperatures; these increases and those observed by other workers are in general agreement with the theory. Further experiments on the magnetoresistivity of very pure Cu were undertaken so as to separate the effects of the dislocations from those of the point defects (the point defects are isotropic scatterers and do not affect the Kohler plots, $\Delta\rho/\rho(0)$ v. $H/\rho(0)$; the effect is entirely due to dislocations, which give anisotropic scattering). The additional magnetoresistivity does not anneal out below 200° C; hence the last stage in the recovery of the normal resistivity, which is observed in this temperature region, is to be associated with the dislocations. It is shown theoretically that the relative change of magnetoresistance is one half the relative increase of normal resistance caused by dislocations. The measurements verify this prediction when the above interpretation of the last annealing stage is made. It may then be concluded that the increase of normal resistance on cold working is half due to point defects (which anneal out at low temperatures) and half due to dislocations. The paper concludes with a discussion of the mechanisms of the low temperature annealing.

A.B.Lidiard

537.311.31 : 538.63

9167. HALL EFFECT OF URANIUM.
F.Boeschoten and C.Huiszoon.
Physica, Vol. 23, No. 7, 704 (July, 1957).

The measured value of the Hall coefficient was 3.4×10^{-11} m³/coulomb, independent of temperature in the range 20° C to 300° C and magnetic field in the range 5000 to 17 000 gauss. R.Stratton

537.311.32

9168. THE ELECTRICAL CONDUCTIVITY OF SOLID IONO-ATOMIVALENT MATERIALS. VIII. THE CONCENTRATION DEPENDENCE OF ELECTRICAL CONDUCTIVITY OF BORATE AND SILICATE GLASSES. R.L.Myuller.
Zh. tekh. Fiz., Vol. 26, No. 12, 2614-27 (1956). In Russian.

The dependence of the molar electrical conductivity of borosilicates on metallic ion concentration is studied. It is determined, to a first approximation, by the dissociation energy. Data on change in dissociation energy are used to explain the change in the conductivity of borosilicates in the region of small alkaline ion concentration and its sharp increase in the region of higher concentrations. The reasons for the lowering of the alkaline conductivity of glass in the presence of alkaline earth oxides are studied. Changes in the conductivity of glasses are thought to be due to chemical rather than structural changes. J.B.Arthur

537.311.32 : 539.213.2

9169. INVESTIGATION OF THE NEUTRALIZING EFFECT OF REDUCTION OF ELECTRICAL CONDUCTIVITY IN SILICATE GLASSES. O.V.Mazurin and E.S.Borisovskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 2, 275-88 (1957). In Russian.

Investigations were made of resistivity of silicate glasses containing one, two, and three alkali oxides. It is shown, that in many alkali–silicate glasses the neutralizing effect (the effect of reduction of electrical conductivity when one alkali oxide is partly replaced by another) is independent of the concentration of the alkali oxide. The effect is more pronounced in potassium–lithium glasses than in the sodium–lithium or the potassium–sodium glasses. Resistivities of glasses of optimal compositions, which contain 33% of alkali oxides, are higher than the resistivities of a number of modern electro-vacuum glasses. Explanation of the neutralizing effect in silicate glasses is possible only if account is taken of the interaction between alkali ions of different dimensions.

Z.Krasucki

537.311.32 : 621.315.612.2

9170. RELATION BETWEEN ELECTRIC CONDUCTIVITY OF GLASSES AND THE ELECTRIC FIELD INTENSITY.
V.A.Presnov and V.I.Gaman.
Zh. tekh. Fiz., Vol. 27, No. 5, 936-9 (1957). In Russian.

The increase of the electric conductivity in strong electric fields obeys an exponential law. The physical causes are increased ion mobility and higher concentration of conductivity ions in strong fields. The theoretical value of the exponential factor agrees satisfactorily with experimental results.

Electrical Research Association

537.311.32 : 538.221 : 537.226.2 : 621.315.612 : 621.318.1

SOME NEW ELECTRICAL AND MAGNETIC CERAMICS.
See Abstr. 9155

537.311.33 : 538.632

9171. AN ATTEMPT TO USE THE LINEAR HALL EFFECT DETECTOR FOR MEASUREMENT PURPOSES.
V.N.Bogomolov and V.D.Vasil'ev.
Zh. tekh. Fiz., Vol. 27, No. 2, 260-1 (1957). In Russian.

In the Hall effect detector, the magnetic field applied to a block of Ge is arranged to alternate at the same frequency as the current through the block, so that a d.c. Hall voltage is generated, proportional to the amplitude of the alternating current. This a.c. magnetic field is derived from the amplified Hall voltage generated in an auxiliary specimen used as a mixer. The detector is thus linear and phase sensitive and can be used to advantage in the measurement of the a.c. Hall effect (see Zhuze and Nikolaev, Zh. tekh. Fiz., Vol. 23, 5, 1953). J.B.Arthur

537.311.33

9172. ON THE THEORY OF THE ELECTRICAL CONDUCTIVITY OF SEMICONDUCTORS AT HIGH FREQUENCIES. I. H.Stolz.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 394-400 (1956). In German.

Under the assumption of the existence of a single relaxation time for electron–lattice interactions the Boltzmann equation is solved for a harmonic of the time-dependent electric field. From the solution the measurements of the dielectric loss could be evaluated. The necessary integrals for the complex electrical conductivity are evaluated for ionic and non-ionic solids. C.A.Hogarth

537.311.33

9173. DETERMINATION OF THE IMPURITY CONCENTRATIONS IN A SEMICONDUCTOR FROM HALL COEFFICIENT MEASUREMENTS. P.A.Lee.
Brit. J. appl. Phys., Vol. 8, No. 8, 340-3 (Aug., 1957).

The equation is derived for the carrier concentration as a function of temperature and the concentrations of the acceptors and donors in a semiconductor. As a result, it is shown how these impurity concentrations may be found experimentally from a determination of the Hall coefficient as a function of the temperature. These methods are applied to the case of p-type silicon which is dealt with in some detail. A.

537.311.33

9174. ON THE TRANSITION TO METALLIC CONDUCTION IN SEMICONDUCTORS. N.F.Mott.
Canad. J. Phys., Vol. 34, No. 12A, 1356-68 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957). A discussion is given of the conductivity to be expected from a crystalline array of atoms when the interatomic distance a is varied. It is shown that both for monovalent atoms and divalent atoms the conductivity is zero at T = 0 when a is large, the wave-function of the system being real so that no current is possible. In both types of atom a discontinuous transition to a state showing metallic conductivity is predicted at a definite value of a. For divalent atoms calculations using Bloch orbitals and localized Wannier functions give essentially the same result; for monovalent metals they do not, and correspond to physically different states of the system. Applications are made to impurity-band conduction in semiconductors, the impurity centres being treated by the usual model as expanded atoms in a uniform dielectric. It is shown that the concentrations at which "metallic" conductivity sets in are not unexpected, but that it is difficult to understand impurity band conduction at lower concentrations unless the semiconductors are "compensated", either chemically or through the presence of dislocations. A.

537.311.33 : 538.63

9175. GEOMETRICAL EFFECTS IN TRANSVERSE MAGNETO-RESISTANCE MEASUREMENTS. J.R.Drabble and R.Wolfe.
J. Electronics and Control, Vol. 3, No. 3, 259-66 (Sept., 1957).

The effect of finite length-to-width ratio and of probe positions on measurements of resistivity in a transverse magnetic field is investigated for various Hall angles. It has been shown by Wick that the Hall effect causes an increase in the resistance between the end contacts of a rectangular specimen. In this paper, Wick's method is extended to include the case of measurements made between probes symmetrically placed at various distances from the ends. It is shown that the "Hall resistance" is negligible when the probes are placed at a distance from the ends greater than the width of the specimen. Graphs are included which give the fractional change of resistance for various probe positions and Hall angles for specimens of any length-to-width ratio greater than two. A.

537.311.33

9176. ON THE QUESTION OF THE SCATTERING OF CURRENT CARRIERS IN SEMICONDUCTORS WITH THE IONIC TYPE OF BOND. T.A.Kontorova.
Zh. tekh. Fiz., Vol. 27, No. 2, 269-74 (1957). In Russian.

The usual theory of the scattering mechanism in ionic semiconductors predicts a mobility law $\mu \propto T^{-1/2}$, assuming that scattering at optical modes is dominant. For most ionic crystals this is true only at high temperatures, the dominant mechanism at low temperatures being acoustic scattering which gives at $T^{-3/2}$ law, as in atomic semiconductors. The author examines the transition region where both mechanisms are operable. Expressions are obtained for mean free path length and carrier mobility. J.B.Arthur

537.311.33

9177. THE DISTRIBUTION OF MINORITY CURRENT-CARRIER CONCENTRATION DUE TO MOTION OF THE INJECTION REGION AND THE PRESENCE OF A FIELD (ON A "NULL" METHOD FOR THE MEASUREMENT OF MOBILITY).
S.M.Ryvkin and Yu.A.Makhalov.
Zh. tekh. Fiz., Vol. 27, No. 3, 441-51 (1957). In Russian.

The symmetry of the equilibrium distribution of injected carriers about the point of injection can be disturbed in two ways: by sweeping the injection point (light spot) over the surface and by applying an external field. The two asymmetriss can be made to balance each other out and measurement of corresponding field and spot velocity yields a value for minority carrier mobility. Theoretical considerations are discussed and the experimental set-up is described. The distribution is displayed on a c.r.t. The time-base waveform is triangular, so that the time-base doubles back on itself and coincidence of the two halves of the distribution accurately determines the balance point. J.B.Arthur

537.311.33 : 538.61

9178. CALCULATION OF THE VOLTAGE FOR THE KIKOIN–NOSKOV PHOTOMAGNETIC EFFECT AND THE DEMBER EFFECT IN STRONG MAGNETIC FIELDS. B.Ya.Moĭzhes.
Zh. tekh. Fiz., Vol. 27, No. 3, 495-501 (1957). In Russian.

The Kikoin–Noskov effect is the voltage appearing across a semiconducting slab when a magnetic field is applied perpendicular to the direction of incident illumination (usually known as the photomagnetoelectric or P.M.E. effect). Calculations are presented for the cases of strong and weak illumination and for thick and thin slabs, all for strong magnetic fields. The Dember, or photodiffusion, effect (the potential difference arising in the direction of illumination due to different rates of diffusion of holes and electrons) is also calculated for the same conditions. J.B.Arthur

537.311.33 : 541.57

9179. THE CHEMICAL BOND IN SEMICONDUCTORS. THE GROUP V B TO VII B ELEMENTS AND COMPOUNDS FORMED BETWEEN THEM. E.Mooser and W.B.Pearson.
Canad. J. Phys., Vol. 34, No. 12A, 1369-76 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957). A brief review is first given of the developments which led to an understanding of the important role played by chemical bonding in semiconductors. The properties of the Group V B to VII B elements and of some compounds formed between these elements are then considered according to the valence bond model of Pauling. This leads to the conclusion that the band scheme in these substances is somewhat different to that which has been generally accepted, and the new model is discussed in relation to their electrical and optical properties. A.

537.311.33

9180. NEW SEMICONDUCTORS WITH THE CHALCOPYRITE STRUCTURE. I.G.Austin, C.H.L.Goodman and A.E.Pengelly.
J. Electrochem. Soc., Vol. 103, No. 11, 609-10 (Nov., 1956).

Compounds of the chalcopyrite group are related to well-known semiconductors such as Ge and the zinc blende compounds. This relationship is discussed briefly and some new data are presented regarding the preparation and properties of five chalcopyrite compounds $AgInS_2$, $AgInSe_2$, $CuInSe_2$, $AgInTe_2$, and $CuInTe_2$. A.

537.311.33 : 537.323

9181. PREPARATION AND INVESTIGATION OF INTER-METALLIC COMPOUNDS IN THE FORM OF THIN LAYERS.
V.A.Presnov and V.F.Synorov.
Zh. tekh. Fiz., Vol. 27, No. 1, 123-6 (1957). In Russian.

Thin specimens were prepared of the following $A^{III}B^{V}$-type

compounds: AlSb, InSb, GaSb, as well as of various pure group IV elements. The specimens were prepared as follows: thin layers each 0.1-1 μ thick were evaporated on top of each other to produce strip specimens with thickness varying (in a direction parallel to the width) from one layer to about fourteen layers. Measurement of the electrical resistivity (ρ) parallel to the length and the thermal e.m.f. (α) gave the following results: (1) ρ for pure group IV semiconductors varied little with thickness (t) and was close to the bulk value; α was very small and difficult to measure. (2) ρ for $A^{III}B^{V}$ films varied greatly with t, having a sharp maximum at 2-3 layers thick; the largest ρ measured was about 30 ohm cm. (3) The variation of α with t for $A^{III}B^{V}$ films was similar to the variation of ρ. The maximum α measured was 220 $\mu V/^{0}C$. (4) The Hall parameter was measured on suitable specimens and was always > 0. The variations of α and ρ with t are ascribed to variation of composition. Maxima correspond to stoichiometric $A^{III}B^{V}$ but the values at maxima differ greatly from bulk values for the same compounds. A.F.Brown

537.311.33

9182. THE OPTICAL ABSORPTION, THE PHOTOELECTRIC AND THERMAL EMISSION AND THE TEMPERATURE DEPENDENCE OF THE CONDUCTIVITY OF CAESIUM–BISMUTH LAYERS. OF VARIOUS COMPOSITIONS. H.G.Clerc and G.Wallis.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 344-52 (1956). In German.

Two types of layer of this semiconductor: I being probably $CsBi_2$ and II – Cs_3Bi were measured. Optical absorption figures for II, measured in the range from about 3 eV to 0.6 eV showed a decrease by a factor of 3 towards 0.6 eV, with no edge apparent in this range. The thermionic emission of I was obtained by making it the cathode in a 12-stage photomultiplier and measuring with precautions the dark current for a small temperature variation. This gave an activation energy of 0.9 eV. With the same assembly the photoelectric yields were measured, being higher for II than for I. Taking the threshold φ as the energy for which the emission was 1% of its maximum value, φ was 1.65 eV for I and 1.5 eV for II. From temperature dependence of the conductivity, activation energies of 0.4 and 0.7 eV were obtained for I. No definite explanations are advanced for the inconsistency of the results. D.Haneman

537.311.33 : 539.576

9183. DEPTH OF SURFACE DAMAGE DUE TO ABRASION ON GERMANIUM. T.M.Buck and F.S.McKim.
J. Electrochem. Soc., Vol. 103, No. 11, 593-7 (Nov., 1956).

The approximate depth of surface damage on Ge as it influences surface recombination velocity has been measured for a variety of abrasive treatments by etching, weighing, and making two types of photomagnetoelectric measurements. Values range from 1μ or less for fine polishes to 35μ for heavy sandblasting. Close correlation is found with changes in reverse characteristics of grown junction p–n diodes treated in the same manner. A.

537.311.33 : 539.219

9184. SOLID SOLUBILITIES AND ELECTRICAL PROPERTIES OF TIN IN GERMANIUM SINGLE CRYSTALS. F.A.Trumbore.
J. Electrochem. Soc., Vol. 103, No. 11, 597-600 (Nov., 1956).

The solid solubility of Sn in Ge has been determined in the range from 400°C to the melting point of Ge using conventional crystal pulling techniques and crystal growth from melts in a thermal gradient. The distribution coefficient changes from 0.020 ± 0.003 at the melting point of Ge to 0.012 ± 0.002 at the lower temperatures, corresponding to solid solubilities of up to about 5×10^{20} atoms/cm^3. X-ray measurements substantiate the conclusion that these relatively large amounts of Sn are in solid solution. In spite of the presence of between 10^{19} and 10^{20} atoms/cm^3 of Sn in the pulled crystals, resistivities as high as 40-50 ohm cm and minority carrier lifetimes as high as 100-200 μsec were obtained. These results confirm the electrical neutrality of Sn in Ge. A.

537.311.33 : 541.183

9185. ADSORPTION OF SODIUM IONS BY GERMANIUM SURFACES. S.P.Wolsky, P.M.Rodriguez and W.Waring.
J. Electrochem. Soc., Vol. 103, No. 11, 606-9 (Nov., 1956).

Sodium ions are adsorbed from a NaOH solution by Ge surfaces during an electrolytic etching process. Techniques for determining approximate quantities and location of the adsorbed ions using radioactive tracers have been developed. Alloyed junction p–n–p transistors, grown junction diodes, and p-type and n-type Ge bars were studied. Results show approximately 10^{15} Na ions/cm^2 to be adsorbed with some concentration at the junction region and at surface cracks. A.

537.311.33

9186. A STUDY OF THE MOTION OF MINORITY CURRENT CARRIERS IN THE BULK IN GERMANIUM.
M.Shtenbek and P.I.Baranskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 2, 221-32 (1957). In Russian.

Holes were injected into n-type Ge at a point contact at a variable audio-frequency. A null method of detection at a point collector enabled an accurate determination of the transit time through the bulk of the specimen to be made. The amplitude, phase shift and deviation in a magnetic field of the signal were measured and used to obtain the drift velocity and the "downstream" and transverse diffusion coefficients. The drift mobility was found to be independent of electric field in the range 2 to 10 V cm^{-1} and to satisfy the Einstein relation in conjunction with the measured "downstream" diffusivity. The observed transverse diffusivity exceeded the longitudinal value. A further experiment, designed to detect light holes, failed to do so. J.B.Arthur

537.311.33 : 548.7

9187. ON THE NATURE OF RECOMBINATION CENTRES OCCURRING IN GERMANIUM DUE TO "LOW-TEMPERATURE" HEAT TREATMENT. T.V.Mashovets and S.M.Ryvkin.
Zh. tekh. Fiz., Vol. 27, No. 2, 238-41 (1957). In Russian.

By "low-temperature heat-treatment" is meant heating to 500° for 10 minutes with subsequent annealing. The activation energy of the recombination centres, estimated from the temperature dependence of lifetime, suggested that the defects are Cu atoms. This was confirmed by further experiments in which Ge specimens were heated in the presence of Pb (which removes Cu from Ge). J.B.Arthur

537.311.33 : 538.63

9188. INVESTIGATION OF THERMOMAGNETIC EFFECTS IN P-TYPE GERMANIUM.
I.V.Mochan, Yu.N.Obraztsov and T.V.Krylova.
Zh. tekh. Fiz., Vol. 27, No. 2, 242-59 (1957). In Russian.

The transverse and longitudinal Nernst–Ettingshausen effects and the Hall effect were measured in 69 ohm cm p-type Ge in the extrinsic temperature range (80 to 240°K) at values of magnetic field of up to 5×10^3 gauss. The theory of thermomagnetic effects is worked out for an arbitrary field, assuming a two-hole model. From a comparison of the experimental data with the theory, it is concluded that the transverse Nernst–Ettingshausen effect is determined by phonon drag on holes (Abstr. 971/1955). The effect of drag on the longitudinal thermomagnetic effect was not detected at low fields; the temperature dependence of the effect at high fields can be explained if phonon drag is taken into account. The value of mobility derived from the low-field longitudinal effect agrees with the Hall value and with Prince's drift measurements (Phys. Rev., Vol. 91, 208, 1953). J.B.Arthur

537.311.33 : 538.63

9189. THE INFLUENCE OF THE DRAGGING OF ELECTRONS BY PHONONS ON THE THERMOMAGNETIC EFFECTS IN SEMICONDUCTORS. V.L.Gurevich and Yu.N.Obraztsov.
Zh. éksper. teor. Fiz., Vol. 32, No. 2, 390-2 (1957). In Russian.

A theoretical investigation of the effect of phonon drag on the transverse and longitudinal Nernst–Ettingshausen effects. The results agree with observed experimental data (see preceding abstract). J.B.Arthur

537.311.

9190. PROPERTIES OF THE INTERSTITIAL COMPOUNDS OF GRAPHITE. IV. PROPERTIES OF N-TYPE COMPOUNDS.
M.L.Dzurus and G.R.Hennig.
J. chem. Phys., Vol. 27, No. 1, 275-81 (July, 1957).

For Pt III see Abstr. 9079 (1952). A method was developed for introducing known quantities of donor impurities into graphite and some electrical properties of such n-type doped graphite were measured at various temperatures. Most of the results are in qualitative agreement with theory, and complement previously published results on p-type compounds. It appears that intercrystalline barriers do not influence the electrical property changes during doping, but that the impurities aggregate to some extent and produce channels which differ in properties from the bulk material.

537.311.33 : 539.2

9191. INTERMETALLIC ALLOYS OF PLATINUM AND GOLD WITH THE ALKALINE AND ALKALINE EARTH METALS.
I.L.Sokol'skaya.
Zh. tekh. Fiz., Vol. 27, No. 1, 127-9 (1957). In Russian.

Thin films were prepared of the following alloys: (1) Na–Au

heating an 0.1μ thick Au film in Na vapour; (2) Na–Pt by evaporation of Pt from a Pt filament heated in Na vapour; (3) Ba–Pt by evaporation of either Ba or Pt on to a heated film of the other. In each case the two-component film had a resistivity higher by several orders of magnitude than either of the pure materials and showed semiconducting properties. The observed increase in resistivity cannot all be ascribed to oxidation, evaporation or structural changes since the pure materials do not show this effect on heating. Most of the rise of resistivity is thus due to the formation of semiconducting intermetallic compounds. The approximate activation energies are: Na–Au = 0.15 eV; Na–Pt = 0.3-0.5 eV; Ba–Pt = 0.2-1 eV.

A.F.Brown

537.311.33 : 537.323

9192. THE ELECTRICAL NATURE OF CERTAIN COMPOUNDS OF TUNGSTEN OXIDE. Z.I.Ornatskaya.
Zh. tekh. Fiz., Vol. 27, No. 1, 130-7 (1957). In Russian.

In the first part experimental results are given by graphs for the temperature dependence of the electrical conductivity and the thermo-e.m.f. coefficient of sodium and lithium tungstate after heat treatment in the atmosphere and in a vacuum up to a temperature of about 550°C. In the second part these electrical properties are measured for the sodium tungstate and lithium tungstate bronzes. An exponential increase in the conductivity is found to occur from room temperature to some 260°C for specimens heated in the atmosphere. Also the conductivity is electronic, not ionic, and the sign of the thermo-e.m.f. coefficient is negative. The stability of the electrical properties is considered. W.Bardsley

537.311.33

9193. ON THE MINORITY-CARRIER CURRENT ACROSS RECTIFYING METAL–GERMANIUM CONTACTS.
G.Mesnard and A.Dolce.
C.R. Acad. Sci. (Paris), Vol. 245, No. 1, 42-4 (July 1, 1957).
In French.

The minority-carrier current is derived as a function of voltage with the introduction of lifetime and surface recombination velocity concepts, starting from the Shockley–Read recombination statistics.

C.A.Hogarth

537.311.33

9194. THE RELATIVE CONTRIBUTION OF MAJORITY AND MINORITY CARRIERS TO THE CURRENT CROSSING RECTIFYING METAL–GERMANIUM CONTACTS. G.Mesnard and A.Dolce.
C.R. Acad. Sci. (Paris), Vol. 245, No. 2, 152-5 (July 8, 1957).
In French.

The hole and electron currents are evaluated at the edge of the space-charge layer as a function of applied voltage. The results are applied in considering whether a particular contact should be used as an emitter or collector. C.A.Hogarth

537.311.33

9195. THE TUNNEL EFFECT IN SULPHIDE RECTIFIERS.
Yu.M.Volokobinskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 6, 1239-42 (1957). In Russian.

The main assumptions and conclusions of the tunnel effect theory of point-contact rectification are stated and some experiments are described in which qualitative confirmation has been observed in Cu_2S rectifiers using aluminium or magnesium contacts.

J.B.Arthur

537.311.33

9196. SURFACE DISCHARGES AT P–N JUNCTIONS.
B.M.Vul and A.P.Shotov.
Zh. tekh. Fiz., Vol. 27, No. 1, 211-12 (1957). In Russian.

Surface arcing over high-voltage (> 400 V) p–n diodes can be prevented only by immersing them in a medium with breakdown potential higher than that for the p–n junction itself. A.F.Brown

537.311.33 : 537.312.5

9197. THE INFLUENCE OF SURFACE RECOMBINATION ON THE EFFICIENCY OF P–N JUNCTION PHOTOCELLS.
G.L.Bir and G.E.Pikus.
Zh. tekh. Fiz., Vol. 27, No. 3, 467-72 (1957). In Russian.

A theoretical analysis of the factors contributing to loss of efficiency in p–n junction photocells. The main factors are (1) incomplete absorption of the light in very short specimens, (2) body and surface recombination and (3) loss of energy to the external circuit as carriers pass through the junction. The optimum conditions are worked out for a Ge photocell, assuming a typical set of parameters. A maximum theoretical efficiency of 41% is calculated.

J.B.Arthur

537.312 : 538.22 : 536.212 : 536.631

9198. REMARKS ON THE ANOMALOUS BEHAVIOR OF ALLOYS CONTAINING TRACES OF MANGANESE OR SIMILAR ELEMENTS.
C.J.Gorter, G.J.van den Berg and J.de Nobel.
Canad. J. Phys., Vol. 34, No. 12A, 1281-4 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957). The anomalous behaviour of alloys containing traces of manganese and similar elements is briefly reviewed as to electric conductivity, magnetoresistance, susceptibility, magnetic resonances, thermoelectricity, specific heat, thermal conductivity, and Hall effect. Special reference is given to recent data obtained in Leyden. It is argued that, while the rapid decrease of the resistance sometimes occurring at very low temperatures apparently must be attributed to some kind of antiferromagnetic alignment, the resistance minimum, as well as the anomalies in thermoelectricity and the Hall effect, might be due to gaps at the crystalline boundaries. A.

537.312.5

9199. THE OPTICAL SENSITIZATION OF PHOTOCONDUCTORS OF THE LEAD SALTS GROUP. V.Schwetzoff.
C.R. Acad. Sci. (Paris), Vol. 245, No. 2, 149-52 (July 8, 1957).
In French.

Optical sensitization with strong (0.1 watt/cm²) visible light at liquid-nitrogen temperatures was studied, mainly for PbSe. Evaporated layers of this were best. The increased relative photoconductivity $\Delta\sigma/\sigma$ was measured with infrared light of wavelength 1 to 7μ and intensity of the order of μ watt/cm². The spectral response of σ was similar for varying degrees of illumination, unlike PbS. $\Delta\sigma/\sigma$ could be increased to three times its non-sensitized value, while σ could be increased by 6×10^3, approaching values for PbS and PbTe. The sensitization lasted several hours at low temperatures. D.Haneman

537.312.5

9200. ON THE PHOTOCONDUCTIVITY OF VIOLANTHRONE AND PYRANTHRONE. A.T.Vartanyan and I.A.Karpovich.
Dokl. Akad. Nauk SSSR., Vol. 113, No. 5, 1020-2 (1957). In Russian.

Films of violanthrone (V) and pyranthrone (P) were prepared by rubbing powdered material on silica, thus avoiding the decomposition which apparently occurs during evaporation. Dark conductivities were appreciable and showed thermal activation energies of 1 eV (V) and 1.15 eV (P). Optical transmission and photoconductive response spectra paralleled each other. Optical activation energies, determined in two ways, were 1.7 eV (V) and 2.2 eV (P), in marked disagreement with the results of Akamatu and Inokuchi (Abstr. 8867/1952). C.H.L.Goodman

537.312.5 : 537.542

9201. ON THE MECHANISM OF THE INFLUENCE OF THE ILLUMINATION BY VISIBLE LIGHT ON THE SIZE OF THE PULSES IN CADMIUM SULPHIDE α-COUNTERS.
A.V.Aĭrapetyants and S.M.Rȳvkin.
Zh. tekh. Fiz., Vol. 27, No. 1, 106-12 (1957). In Russian.

The conductivity of the CdS crystal in α-counter has been varied by illumination with visible light and in one case by heating. The dependence of the size of the pulses in CdS crystal α-counter, the pulse current and the lifetime of carriers, on the conductivity of the crystal is investigated experimentally. It is claimed that the results verify the semiconducting character of the formation of the pulses in CdS crystals (Abstr. 6729/1956). J.M.Zarzycki

537.312.62 : 536.631

THE SPECIFIC HEAT OF THE SUPERCONDUCTORS Al, Sn AND V BELOW 1°K. See Abstr. 9141

537.312.8

9202. GALVANOMAGNETIC PROPERTIES OF TELLURIUM AT LOW TEMPERATURES. S.S.Shalȳt; Yu.N.Obraztsov.
Zh. tekh. Fiz., Vol. 27, No. 1, 189-201; Addendum 202-3 (1957).
In Russian.

An experimental investigation of the temperature dependence of the electrical properties from 100°C to 1.3°K, together with the Hall effect and the variation of resistance in a magnetic field up to 26 000 oersteds at room, nitrogen and helium temperatures. It is necessary to postulate two groups of holes of different mobilities and figures for these mobilities are given. The advantages of zone-refining tellurium are considered and the resistivity of different specimens of various purities produced by this method is investigated over the temperature range 400°-1.3°K. W.Bardsley

537.32 : 536.48

9203. THERMO-ELECTRICITY AT LOW TEMPERATURES. IV. VARIATION OF THERMO-ELECTRIC POWER IN A MAGNETIC FIELD. D.K.C.MacDonald and W.B.Pearson.
Proc. Roy. Soc. A, Vol. 241, 257-69 (Aug. 7, 1957).

For Pt III, see Abstr. 8786 (1955). Experiments have been made on the variation of thermoelectric power of pure sodium and copper and alloys of copper at low temperatures in a magnetic field. The variation in the pure metals is very small and in the case of sodium is qualitatively and quantitatively at variance with theory. The experiments on the alloys are well interpreted in terms of magneto-resistive behaviour and show that the anomalous scattering in copper + iron and copper + tin alloys is not affected significantly by a magnetic field. A.

537.321

9204. ON THE ELEMENTARY THEORY OF THERMOELECTRIC PHENOMENA. R.Stratton.
Brit. J. appl. Phys., Vol. 8, No. 8, 315-21 (Aug., 1957).

The theory of thermoelectric phenomena is deduced from the general theory of conduction in a metal or semiconductor. The calculation is discussed in great detail to bring out the significance of the various thermoelectric parameters. All the relations between the thermoelectric parameters are deduced from physical properties rather than by simply carrying out mathematical transformations. The sources of the heat and electromotive force developed are clearly indicated. A.

537.322 : 537.323

9205. AN EXPERIMENTAL STUDY OF THE CONNECTION BETWEEN THE PELTIER EFFECT AND THE THERMOELECTRO-MOTIVE FORCE IN GERMANIUM. M.Shtenbek and P.I.Baranskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 2, 233-7 (1957). In Russian.

An extension of some previous measurements by the same authors (Abstr. 6662/1956). N- and p-type specimens with room temperature resistivities from 0.1 to 12 ohm cm were studied in the temperature range 160 to 400°K. It was confirmed that, in the extrinsic range, the Peltier coefficient $P \neq \alpha T$ (where α = thermoelectric power, T = absolute temperature). In the intrinsic range, however, $P = \alpha T$. The specific heat of the electron (or hole) gas was estimated from the temperature dependence of P in the in intrinsic range and was found to agree with the value for a classical ideal gas, viz. 3/2 k. J.B.Arthur

537.323

9206. INFLUENCE OF THICKNESS ON THE THERMOELECTRIC POWER OF THIN FILMS OF ALUMINIUM AND COBALT. F.Savornin.
C.R. Acad. Sci. (Paris), Vol. 245, No. 2, 147-9 (July 8, 1957). In French.

The thermoelectric power of thin films of Al heated after deposition increases because of superficial oxidation. The thermoelectric power of Co films increases with increasing thickness but the effects of oxidation are less severe. C.A.Hogarth

537.323 : 536.413 : 536.21

THERMOELECTRIC PROPERTIES OF THE ALLOYS OF SILICON WITH THE TRANSITION METALS. See Abstr. 9131

537.324

9207. JUXTAPOSITION THERMOCOUPLES IN THE FORM OF THIN FILMS. A.Aron.
C.R. Acad. Sci. (Paris), Vol. 245, No. 1, 48-50 (July 1, 1957). In French.

These thermocouples are made by vacuum evaporation of Al or Ag on to Pyrex glass, the other elements being layers of two semiconductors deposited by the same means. Semiconductors used include Cu_2O, Te, antimony oxide. C.A.Hogarth

537.324

9208. THE COMMUTATION [KOMMUTATSIYA] OF SEMICONDUCTING THERMOELEMENTS. L.S.Stil'bans.
Zh. tekh. Fiz., Vol. 27, No. 1, 212-13 (1957). In Russian.

The properties of thermojunctions used as cryogenic devices can be improved by tinning the wires so as to decrease their resistivity. A suitable tinning material is a Bi–Sn alloy containing excess of Bi above eutectic composition. At temperatures less than 100° C diffusion of this alloy into the thermocouple wires is negligible. A.F.Brown

ELECTRIC DISCHARGES 537.52

537.523.5 : 537.525.5

9209. THE INFLUENCE OF CONVECTION ON HORIZONTAL ARC DISCHARGES. F.Kümmel and B.Winde.
Abhandl. Dtsch. Akad. Wiss. Berlin, Kl. Math. Phys. Tech. (1956; publ. 1957), No. 2, 16 pp. In German.

An experimental and theoretical study of convection losses from short arcs (length up to 1 cm) carrying currents up to about 4 A for a pressure range of approximately 0.2-1 atm. Detailed numerical data are presented. J.D.Cragg

537.525 : 538.56

9210. THE THEORY OF ELECTRIC WAVES IN INHOMOGENEOUS PLASMAS. K.Kischel.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 309-21 (1956). In German.

A theoretical study of longitudinal waves established in inhomogeneous plasmas (i.e. those with spatial variations of electron density). It is assumed that charged–neutral particle collisions are negligible compared with collisions between charged particles. Amplification, dispersion etc. are discussed. J.D.Cragg

537.525 : 538.56

9211. THE MEASUREMENT OF ELECTRON TEMPERATURES BY MICROWAVE METHODS. A.N.Dellis.
Atomic Energy Res. Establ. (Harwell), Rep. GP/R2265, 8 pp. (1957).

A discussion is given of the emission of electromagnetic radiation by a gas discharge plasma at frequencies well above the electron collision frequency. It is shown that this emission is considerably enhanced just above the critical frequency. Some experiments are briefly described in which this radiation has been measured in the microwave region and the result used to evaluate the electron temperature of the plasma. A

537.525 : 538.56

9212. RADIATION FROM A PLASMA. W.B.Thompson.
Atomic Energy Res. Establ. (Harwell) Mem. T/M73, 8 pp. (1957).

The radiation due to free–free transitions in a gas discharge at high temperatures is calculated both by a semiclassical argument, and by integrating the effect of Heitler's bremsstrahlung cross-section over the collisions. The resulting expressions are compared with a formula produced by Cillie (1932) for the radiation from an ionized gas in thermal equilibrium, and all expressions are found to be of the same order of magnitude. A cross-section due to Redhead (Abstr. 3869/1953) for radiative collisions between electrons is used to show that this process radiates negligible power. Numerical results are tabulated for ionized hydrogen. A

537.525 : 538.56

9213. ON A GENERALIZED THEORY OF A LORENTZIAN PLASMA SUBJECTED TO A NONPERIODIC FORCE AND IN WHICH CERTAIN INELASTIC COLLISIONS OCCUR. R.Jancel and T.Kahan.
C.R. Acad. Sci. (Paris), Vol. 244, No. 21, 2583-6 (May 20, 1957). In French.

A method for solving Boltzmann's equation, described in a previous note (Abstr. 7128/1957) is used to study the Lorentz plasma. An integro-differential equation is found for the longitudinal oscillations. The equations are taken up to the terms involving second-order approximations. L.S.Goddard

537.525 : 538.56

9214. CONDITIONS FOR DISCHARGE IN AN ELECTRO-MAGNETIC CAVITY AND PROGRESSIVE WAVES IN LORENTZIAN PLASMAS. R.Jancel and T.Kahan.
C.R. Acad. Sci. (Paris), Vol. 244, No. 24, 2894-6 (June 12, 1957). In French.

The general equations describing the behaviour of the plasma an electromagnetic field were obtained in previous papers (Abstr. 7128/1957 and preceding abstract). They are now used to study the discharge in a closed plasma and the propagation of progressive waves in an infinite plasma. L.S.Goddard

537.5

9215. SILENT ELECTRICAL DISCHARGE IN AIR AT LOW FREQUENCY, USING INSULATING ELECTRODES. D.P.Jatar and H.D.Sharma.
C.R. Acad. Sci. (Paris), Vol. 245, No. 4, 414-16 (July 22, 1957). In French.

Joshi effect was measured using beeswax electrodes. A.E.D.Heyl

537.525 : 537.312.5

9216. MECHANISM OF DISCHARGE IN A HOLLOW CATHODE. V.A.Gromov.
Optika i Spektrosk., Vol. 1, No. 3, 334-7 (1956). In Russian.

Recent work on the theory of discharge mechanism in such cases attributes an important part to photoemission of electrons from the cathode. The purpose of this work is to show that certain information about the discharge mechanism can be obtained with small additions of multiatomic gases. C.R.S.Manders

537.525

9217. ELECTRONIC OSCILLATIONS IN PLASMA. F.Berz.
Vide, Vol. 11, 338-44 (Sept.-Oct., 1956). In French.

For background see Abstr. 2274 (1957). A discussion of the results recently obtained by the author, which show that undamped waves are not excited but that for $\omega_0 \leq \omega \leq 1.05\ \omega_0$, where $\omega_0 = 2\pi \times$ × (plasma frequency) and for $30\ \lambda_D < \lambda < \infty$, where λ_D = Debye wavelength, the damping is very small. A.H.W.Beck

537.525

9218. INVESTIGATION OF PENETRATING PLASMA DURING A DISCHARGE IN MERCURY VAPOUR.
M.D.Gabovich and E.T.Kucherenko.
Zh. tekh. Fiz., Vol. 27, No. 2, 299-308 (1957). In Russian.

When an ion beam is formed from a discharge plasma there must be some intermediate region where the transition takes place from one of chaotic ion motion to one where the ions are in directed motion. The present paper makes some study of this intermediate region using a probe technique. Through an aperture in the wall of the discharge apparatus plasma penetrates into a region of low pressure. With no electric field this plasma spreads to distance larger than the diameter of the hole. Study is made of the space distribution parameters of this penetrating plasma, and of the effect of electric and magnetic fields on it. C.R.S.Manders

537.525

9219. RESONANCE METHOD FOR DETERMINING THE ELECTRON DENSITY AND THE NUMBER OF COLLISIONS IN THE PLASMA OF A GASEOUS DISCHARGE. I.I.Vasserman.
Zh. tekh. Fiz., Vol. 27, No. 3, 516-21 (1957). In Russian.

The study of resonance properties of a circuit, in which a discharge tube is placed between the plates of a condenser, enables determination of the mean values of n, the electron density, and ν, the frequency of electron collisions with atoms in the plasma. Results are presented of investigations of the plasma of mercury vapour at pressures of about 10^{-3} mm Hg and at frequencies of the order of 20 Mc/s. Z.Krasucki

537.525.4

9220. THE MECHANISM OF PARTICLE ACCELERATION IN HIGH CURRENT SPARK DISCHARGES. S.Nagao.
Brit. J. appl. Phys., Vol. 8, No. 9, 380-1 (Sept., 1957).

Gives a suggested explanation, in terms of a cavity-resonator model of the plasma, of the presence of high-energy particles in the Kurchatov experiments (high-current sparks). J.D.Craggs

537.525.5 : 535.337

BROADENING AND DISPLACEMENT OF SPECTRAL LINES IN A GAS DISCHARGE PLASMA. See Abstr. 9071

537.525.8

9221. INVESTIGATION ON THE ANODE REGION OF GLOW DISCHARGES. W.Weizel and H.Hornberg.
Forschungsber. Wirtsch.-Verkehrsmin. Nordrhein-Westfalen, No. 335, 49 pp. (1956). In German.

An exhaustive investigation of the anode-fall region of glow discharges, with incidental reference to other parts (e.g. the Faraday dark space) of such discharges. Plasma conditions near the anode are given particular attention and secondary processes at the anode are more briefly dealt with. Beaded discharges ("pearls") at anodes are also described. There are three plates of coloured photographs of the various regimes in air and nitrogen discharges for currents of 9-990 mA, pressures of 0.05-9 mm Hg. J.D.Craggs

537.527

9222. ON THE BREAKDOWN VOLTAGE AND THE IGNITION DELAY (TIME LAG) IN NITROGEN AT HIGH PRESSURE. G.List.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 283-97 (1956). In German.

Experimental determinations of the breakdown voltage for N_2 at gas pressures of 4 to 100 atm in small gaps (0.150 and 0.482 mm) show that departures from Paschen's law occur at field strengths ~4×10^5 V/cm. For field strengths greater than this value it is shown that the mean statistical time lag is of the order of seconds even for over-voltages up to 20%. The results indicate that the initial electrons produced by field emission have only a small probability of leading to a spark. J.Dutton

537.527.4 : 539.169 : 621.3.015.5 : 621.315.618.2

9223. α-, β- AND γ-RADIATIONS AND DIELECTRIC STRENGTH OF COMPRESSED AIR. M.I.Sÿsoev.
Elektrichestvo, 1957, No. 5, 56-9. In Russian.

Natural radioactivity of air is suspected to influence the dielectric strength of air, especially at higher pressures, when the number of disintegrations per unit volume is increased. The breakdown of air has been studied in the pressure range 1-15 atm by means of alternating (50 c/s) and pulse voltages. The sparking distance was 90 mm and the gap had facilities for irradiation with radioactive elements. The results are presented in eight graphs. With short pulses and positive polarity of the electrode with small radius of curvature, additional artificial radioactivity lowers the dielectric strength of air. With longer pulses or a.c., additional radioactivity makes no difference and it is thought that here the natural radioactivity has a sufficiently strong effect. With negative polarity of the electrode of small radius of curvature, additional radioactivity has no effect. The results are discussed and their explanation is given. A.Woroncow

537.529 : 539.232

9224. THE INFLUENCE OF THE ELECTRIC FIELD ON THE PROPERTIES OF THIN DIELECTRIC AND SEMICONDUCTING LAYERS. Yu.M.Volokobinskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 5, 1023-4 (1957). In Russian.

Pre-breakdown voltage–current characteristics of certain metallic oxides in the form of thin layers (30 to 1000 angstroms) were studied. They were found to be exponential and reversible, i.e. breakdown does not necessarily take place as soon as the current increases. J.B.Arthur

537.529

9225. THE APPROXIMATE RELATIONS FOR THERMAL BREAKDOWN OF SOLID INSULATING MATERIALS.
V.V.Puchkovskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 2, 374-6 (1957). In Russian.

The case of a thin plate with dielectric losses concentrated in a central layer is discussed and solved in series form giving the time as a function of increase of temperature. For the case where (i) no heat is imparted to the medium, and (ii) heat losses are independent of temperature, exact solutions are given. Assuming (i) and (ii) simultaneously the temperature changes linearly with time, and for this case the thermal breakdown voltage is found. The formula differs from those of others by a numerical coefficient. M.W.Makowski

X-RAYS 537.531

537.531 : 535.43 : 548.7

9226. ANISOTROPIC SMALL-ANGLE SCATTERING OF X-RAYS IN GRAPHITE. J.Auleytner and M.Lefeld.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 3, 291-4 (1957).

The small angle scattering of X-rays in graphite was investigated by irradiating a rod of graphite 0.5 mm diameter with a collimated beam of monochromatic rays from a fine focus (25 micron) tube. From the X-ray scattering curves, it is possible to calculate the average size of the dislocations. The latter were found to be about two orders smaller in size than the crystallites themselves. The X-ray scattering is anisotropic. T.Mulvey

537.531 : 535.343

9227. THE FORM OF THE M-ABSORPTION DISCONTINUITIES OF GOLD. C.Mande.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 662-4 (Aug. 5, 1957). In French.

The M-absorption discontinuities of gold in the form of thin films have been investigated. A bent-crystal spectrometer was used. The M_{III} discontinuity is similar in form to that of L_{III}, and both the M_{IV} and M_V discontinuities can be resolved into three successive edges. T.Mulvey

537.531 : 535.331 : 541.57

9228. THE INFLUENCE OF THE CHEMICAL BOND ON THE FINE STRUCTURE OF THE Kβ-GROUP LINES OF X-RAY EMISSION SPECTRA OF TITANIUM IN CERTAIN COMPOUNDS. É.E.Vaĭnshteĭn and Yu.N.Vasil'ev.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 1, 53-6 (1957). In Russian.

The paper describes an experimental study of the K-series spectra of titanium obtained from the oxide, carbide and nitride respectively. The purpose of the investigation was to provide data for spectral theory and to investigate the influence of chemical bonding on the spectral lines. Details are given of the specimen preparation. A bent crystal spectrometer was used to analyse the K-emission spectra. The effect of chemical bonding in altering the shape and position of a given line is discussed. T.Mulvey

537.531.7 : 539.166.75

9229. X-RAY ATTENUATION COEFFICIENTS FROM 10 keV TO 100 MeV. G.W.Grodstein.
Circ. Nat. Bur. Stand., No. 583, 54 pp. (1957).

A tabulation of attenuation coefficients of X-rays and gamma-rays from 0.01 to 100 MeV for 29 materials is presented. A summary of information on the probability of the basic interaction processes of photons with matter and a detailed analysis of experimental and theoretical evidence are included. Present information on the basic processis is adequate for many applications; however, improved theory and additional experimental data are needed in certain areas. A comparison of calculated and experimental coefficients points up this need. 86 refs. A.

CATHODE RAYS. POSITIVE RAYS
537.533/.534

537.533 : 537.534

9230. LINEAR THEORY OF SYNCHROTRON OSCILLATIONS. II. PARTICLE LOSSES DURING ACCELERATION AND TOLERANCE THEORY. L.L.Goldin and D.G.Koškarev.
Nuovo Cimento, Vol. 6, No. 2, 286-98 (Aug., 1957).

For previous part, see Abstr. 2919 (1956). Various types of synchrotron oscillation perturbations of accelerated particles are examined from the standpoint of the particle losses they produce. A system of tolerances for a prescribed particle loss is set up. A.

537.533.2

9231. THE ELECTROSTATIC EMISSION FROM A TANTALUM SINGLE CRYSTAL.
N.A.Gorbatyĭ, L.V.Reshetnikova, E.P.Sytaya and G.N.Shuppe.
Zh. tekh. Fiz., Vol. 27, No. 2, 296-8 (1957). In Russian.

Spherical projectors were made up with Ta points. A specimen etched with 90% HF + 10% HNO_3, used in vacuum conditions $\cong 10^{-11}$ mm Hg, heated to 2600°K, gives a picture exactly corresponding to those for W and Mo. Photographs are given for a specimen in a variety of conditions such as: insufficiently annealed, heated at 2600°K, heated to 1000-1100°K, specimen with soiled surface. Treatment of the point by a reversed field leads, in the case of Ta, to a considerable increase of emission current.
C.R.S.Manders

537.533.35

9232. A PHOTOEMISSION ELECTRON MICROSCOPE. E.L.Huguenin.
Ann. Phys. (Paris), Ser. 13, Vol. 2, No. 3-4, 214-266 (March-April, 1957). In French.

Photoelectrons obtained from the specimen surface by illuminating with a high-pressure mercury lamp are accelerated by 25 kV potential and used to form an image at 200 X magnification with an electrostatic immersion objective (30 X) and a projector lens. The effect of ion bombardment, which is used to clean the surface has been studied in detail. True crystalline contrast due to orientation variation of photoemission may be obtained by first bombarding the surface severely with argon ions. Metals studied include Ag, Cu, Zn, Au, U. J.W.Menter

537.533.35

9233. INTERFERENCE MICROSCOPY AND MEASUREMENT OF THE PHASE DIFFERENCE INTRODUCED BY A FILM IN ELECTRON MICROSCOPY. J.Faget and C.Fert.
C.R. Acad. Sci. (Paris), Vol. 244, No. 19, 2368-71 (May 6, 1957). In French.

Use is made of the electron interference microscope previously described (Abstr. 5377/1957) to examine the phase changes produced in electrons traversing a thin film. It has been verified that thin films do not affect the coherence of the electron beam. Variations in film thickness are revealed by a relative displacement of the fringes. The deposition of contamination on a carbon film has also been studied in this way. A.E.I. Research Laboratory

537.533.35

9234. ELECTROSTATIC ELECTRON VELOCITY ANALYSER. V.I.Milyutin and A.N.Kabanov.
Uspekhi fiz. Nauk, Vol. 61, No. 4, 673-98 (1957). In Russian.

The apparatus is described in some detail and is essentially an electron microscope adapted for use as an electron spectrograph. In its mode of action the instrument makes use of the strong chromatic effect of the boundary zone (i.e. well off the axis) of a single electrostatic lens, the region in question being very sensistive to change of velocity of electrons traversing it. Results are given of an analysis of the energy losses of fast electrons passing through layers of various substances of thickness 200-500 A. The energy analysis of electron diffraction patterns is also discussed. 28 references. C.R.S.Manders

537.533.71

9235. INVESTIGATION OF REFLECTION OF ELECTRONS FROM DIELECTRICS. T.L.Matskevich.
Zh. tekh. Fiz., Vol. 27, No. 2, 289-95 (1957). In Russian.

Investigations were made of the dependence of the reflection coefficient, η, of electrons from a number of dielectrics on the energy, Up, and on the angle of incidence of primary electrons. It is shown that: (i) The reflection coefficient is independent of the energy of primary electrons in the region of U_p from 1 to 5 KeV; the value of η for dielectrics is of the same order of magnitude as that for metals. (ii) The reflected electrons have a continuous energy spectrum up to U_p. Z.Krasucki

537.533.74 : 539.152.1

INELASTIC SCATTERING OF ELECTRONS BY NUCLEI. See Abstr. 8772

537.533.75 : 778.34

9236. THE APPLICATION OF NUCLEAR EMULSIONS TO THE STUDY OF β-PARTICLES. G.Marguin.
Ann. Phys. (Paris), Vol. 2, No. 5-6, 318-68 (May-June, 1957). In French.

A thesis in three parts with 57 references. Pt I considers methods for processing nuclear emulsions up to 1000 μ thick Distortion was found to be minimized by impregnation with glycerine Soaking for 15 hours at 20°C in 20% glycerine followed by the usual drying restored the original thickness for G5 emulsion 100 μ thick, and thereby also allowed greater precision in dip measurements. Background tracks were removed by keeping 100 μ emulsions in air saturated with water vapour at 60°C for 10-15 hr, and a twofold increase of sensitivity (g_{min} = 50/100 μ) was produced near the edges. Pt II includes energy measurements of 170-780 keV electrons by multiple scattering using a projection microscope. The experimental value for the scattering constant, 20.7 ± 1.6 deg.MeV (100 μ)$^{-1/2}$ agreed well with the calculated value of 21.6. Pt III is devoted to the transmission of 100-140 keV positrons and electrons by thin metal foils, using nuclear emulsions as detectors. For Pt and Ag, positrons had a higher relative transmission, but for Al the values were the same for β^+ and β^-. For Pt and Ag foils of 18.8 and 12.6 mg.cm^{-2} respectively, the absorption limits were 107 and 95 keV for β^+ and 121 and 100 keV for β^-. E.J.Burge

537.533.

9237. THEORY OF SECONDARY EMISSION. R.G.Lye and A.J.Dekker.
Phys. Rev., Vol. 107, No. 4, 977-81 (Aug. 15, 1957).

The elementary theory of secondary electron emission devlope by Salow, Bruining, Baroody, and others, is generalized and modifi to incorporate recent measurements by Young of the range—energy relation and the dissipation of energy by slow electrons in solids. It is found that these modifications give considerably improved agreement between the theoretical and experimental "universal" re duced yield curves. However, for primary energies several times higher than that for which the yield has its maximum value, deviations occur; the reduced yield curve for metals appears to lie slightly above the theoretical curve, while that for MgO falls increasingl below. Similar results are found for Ge, but the agreement is bett than for MgO. A

537.534.3

9238. A RADIOFREQUENCY MASS SPECTROMETER. E.F.Doil'nitsyn, A.I.Trubetskoĭ and M.Ya.Shcherbakova. Zh. tekh. Fiz., Vol. 27, No. 2, 404-9 (1957). In Russian.

Describes and illustrates in detail the design of a Bennett-type (Abstr. 2503/1950) radiofrequency mass spectrometer constructed by the authors with the aim of analysing mixtures of light and inert gases. The resolving power of the apparatus rises up to 24. It is claimed that the apparatus can find a wide use as an automatic gas analyser. F.Lachman

537.534.3

9239. CALCULATION OF THE RESOLVING POWER AND CHOICE OF [NUMBER OF] CYCLES FOR A THREE-STAGE RADIO-FREQUENCY MASS SPECTROMETER. M.Ya.Shcherbakova. Zh. tekh. Fiz., Vol. 27, No. 3, 599-605 (1957). In Russian.

The three-stage Bennett mass spectrometer (in which ions are velocity selected by being accelerated through a series of grids, to certain of which is applied a r.f. potential) is analysed and a formula for resolving power is obtained. The spacing between stages is governed by phase considerations and must be such that the r.f. potential executes an integral number of cycles while an ion is crossing the drift space. The choice of this number influences the harmonic content of the result. A method is given for determining the optimum number of cycles for each of the two drift spaces. J.B.Arthur

DISCHARGE TUBES. COUNTERS 537.54

537.542

9240. ON A PROBLEM OF OPERATION OF HELIUM-FILLED PROPORTIONAL COUNTERS AT LOW TEMPERATURES. A.V.Kogan, N.M.Reĭnov, I.A.Sokolov and M.F.Stelmakh. Zh. tekh. Fiz., Vol. 27, No. 2, 429-31 (1957). In Russian.

Variation of the gas amplification with the voltage on the wire is investigated for 300, 77, 4.2°K. The gas amplification is shown to be less for low temperatures and this may be due to a redistribution of potentials caused by a film of helium on the surface of the wire. J.M.Zarzycki

537.542

9241. ON THE SHAPE OF THE ELECTRON PULSE IN AN IONIZATION CHAMBER. V.A.Dmitriev. Zh. tekh. Fiz., Vol. 27, No. 1, 205-6 (1957). In Russian.

Equations for the shape of the electron pulse in a cylindrical ionization chamber were derived and are quoted for $V = V_0$ in the two cases: (i) uniform volume ionization and (ii) constant ionization across diameter. Curves for $V = V_0$, as well as for $V = kE^{1/2}$ are plotted and are shown to be of similar shape. Theoretical discussion on the shape of the curves follows. J.M.Zarzycki

537.542 : 537.312.5

CADMIUM SULPHIDE α-COUNTERS. See Abstr. 9201

537.542

9242. METHODS OF FAST TRIGGERING OF TRACK DETECTORS. S.Focardi, C.Rubbia, G.Torelli and F.Bella. Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 275-82 (Jan., 1957). In Italian.

Operating conditions of spark counters are investigated and new fast coincidence circuits, based on the use of spark counters, are described and discussed, with particular reference to the problem of generating high-voltage pulses (up to 15 kV) having a fast rise time, triggered by the random passage of charged particles. The resolving power of the coincidences as well as the delay time between the passage of the particle and the front of the pulse may easily be reduced to a few tens of millimicroseconds. G.Martelli

537.542

9243. OPERATING CHARACTERISTICS OF A GAS–LIQUID BUBBLE CHAMBER. F.W.Bullock, C.Dodd, C.Henderson and G.Kalmus. Nuovo Cimento, Vol. 6, No. 2, 334-9 (Aug., 1957).

Experiments have been performed to determine the effect of temperature on the sensitivity of a bubble chamber filled with various concentrations of methane gas in liquid propane. It has been found that as the concentration of methane is increased the operating pressure, for any given degree of sensitivity, increases by about 0.3 atmosphere for every 1°C decrease in temperature achieved. A.

537.542

9244. OBSERVATIONS ON THE OPERATION OF A CLOUD CHAMBER WITH OVERCOMPRESSION. E.Fiorini, R.Giacconi, A.E.Sichirollo and C.Succi. Nuovo Cimento, Vol. 6, No. 2, 355-63 (Aug., 1957). In Italian.

An overcompressed cloud chamber of a particularly simple type obtained by modifying a conventional cloud chamber is described. Phenomena connected with the overcompression have been studied and the parameters from which is deduced the recycling time reduction, and the clearing efficiency of the chamber analysed. A.

537.542.22 : 537.583

9245. THE DIFFUSION OF BARIUM IN DISCHARGE TUBES. M.A.Cayless and A.D.Forster-Brown. Brit. J. appl. Phys., Vol. 8, No. 9, 380 (Sept., 1957).

A brief discussion of the observed phenomena of localized deposition of sputtered barium, from discharge-tube cathodes, on the tube wall. It is suggested that initial spatial variations of wall work function will lead to selective deposition at points of low work function. J.D.Craggs

IONIZATION. THERMIONICS 537.56/.58

537.56

9246. PULSED HYDROGEN-ION SOURCE AT VERY LOW FREQUENCY USING A TITANIUM FILAMENT. J.Desjonqueres and R.Geller. Vide, Vol. 12, 162-6 (March-April, 1957). In French.

A high-frequency discharge is maintained in a tube containing a titanium filament in an atmosphere of hydrogen at one end. By sending a low-frequency pulsed heating current through the filament it alternately absorbs and emits hydrogen thus producing pulses of gas pressure, hydrogen-ion pulses being emitted from the other end of the tube. The system has the advantage of requiring a much smaller supply of gas and, for a given ion current, a pump of much lower pumping speed for the accelerator tube. R.C.Glass

537.561

9247. IONIZATION POTENTIALS OF AMMONIA AND SOME AMINES. K.Watanabe and J.R.Mottl. J. chem. Phys., Vol. 26, No. 6, 1773-4 (June, 1957).

The ionization potentials of 15 amines were measured and that of ammonia re-measured with a one-metre monochromator having a resolution of 0.5 A by a photoionization method. They range from 8.97 to 7.23 eV for the amines. That of ammonia is 10.154 ± 0.01 eV. The results are discussed and it is concluded that the $3a_1$ electrons of the N atom associated as they are with the first ionization potentials are somewhat antibonding. W.Good

537.564

9248. THE ATTACHMENT OF SLOW ELECTRONS IN OXYGEN. J.D.Craggs, R.Thorburn and B.A.Tozer. Proc. Roy. Soc. A, Vol. 240, 473-83 (July 16, 1957).

The cross-section for resonant electron capture in oxygen has been measured by means of a Lozier apparatus. The value obtained, $2.25 \pm 0.3 \times 10^{-18}$ cm^2 at 6.7 eV, has been employed to calculate the attachment cross-sections to be expected at various mean energies in electron swarm conditions, assuming a Maxwellian distribution of velocities, and it has been shown that all previous attachment coefficient values are compatible with the resonant capture. Reasons have been advanced for doubting the accuracy of the Tate and Smith values of positive-ion cross-sections at lower electron energies. A.

537.564

9249. STUDIES OF THE IONIZATION OF MOLECULES BY ELECTRON IMPACT. II. EXCITED STATES OF THE MOLECULAR IONS OF METHANE AND THE METHYL HALIDES. D.C.Frost and C.A.McDowell. Proc. Roy. Soc. A, Vol. 241, 194-207 (Aug. 7, 1957).

For Pt I, see Abstr. 9732 (1955). The ionization of methane and the methyl halide molecules by essentially mono-energetic electrons, produced by pulse techniques, has been studied in detail in a mass spectrometer. It has been possible to detect for the first time the production of the molecular ions of these compounds in most of their excited electronic states. In the cases of the ions of methyl

bromide and iodide resolution has been obtained of the components of the doublets of the ground ^2E states with arise from spin-orbital interactions in these molecular ions. The several ionization potentials of each of the molecules which refer to the formation of the ions in their different electronic excited states have been measured. These new results are of interest in that they enable the molecular-orbital theories of the electronic structures of methane and the methyl halides to be assessed. They also provide support for recent theories of the origin of the ions in the mass spectra of organic compounds. It has been demonstrated that there is a monotonic relationship between the ionization potential of electrons in the $[\sigma a_1]$ bonding orbital localized in the C—X bond of these molecules and the corresponding bond dissociation energy. A.

537.564 : 537.533.2

9250. GASEOUS AND SURFACE REACTIONS INVOLVING HELIUM METASTABLE ATOMS AND RESONANCE PHOTONS. R.F.Stebbings.
Proc. Roy. Soc. A, Vol. 241, 270-82 (Aug. 7, 1957).

The absolute electron yield (γ_M) for He(2^3S) metastable atoms incident on a gold surface has been measured. The method requires passage of a metastable atom flux through a collision chamber containing argon and thence to the gold surface. From observations on the current of argon ions arising from collisions of the type $He(2^3S) + A \rightarrow He + A^+ + e$, together with measurements of the electron emission from the gold surface, γ_M may be determined. The total cross-sections for collisions between metastable helium atoms and He, Ne, A and K have been measured and in the asymmetrical cases are observed to rise linearly with increasing atomic number of the target atom. Some collisions involving helium resonance radiation have also been studied. In particular, the photoelectric yield from the gold surface has been determined together with the attenuation of the photon flux in passage through certain noble gases. A.

537.583 : 537.512.5

9251. BEHAVIOUR OF THE DARK CURRENT OF UNFOCUSED SECONDARY-EMISSION MULTIPLIERS WITH Cs_3Sb PHOTOCATHODES. F.Eckart.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 133-44 (1956). In German.

The thermionic emission of antimony—caesium photocathodes was measured in the temperature range 20-50 °C, by the use of special photomultipliers with high insulation. An average value of 1.2 eV was found for the work function, a value 0.2 eV smaller than that found from the threshold wavelength of the external photoelectric effect. A discussion is given of the difference between the activation energies obtained from measurements of optical absorption and of photoelectric emission. B.Meltzer

537.583 : 621.327.534.15 : 621.385.032.213.13

9252. THE EMISSION FROM OXIDE CATHODES IN LOW PRESSURE DISCHARGES. M.A.Cayless.
Brit. J. appl. Phys., Vol. 8, No. 8, 331-6 (Aug., 1957).

It is shown that measurements made in vacuum on oxide-coated discharge cathodes are unreliable as a measure of the properties of the cathode in the gas atmosphere of the discharge. Several known methods of measuring the zero-field emission of cathodes in gas atmospheres are found to give rise to difficulties when applied to oxide cathodes in several millimetres pressure of rare gas. A method is described in which these difficulties are avoided and it is applied to a study of cathodes of the fluorescent lamp type. It is found that the zero-field emission of these cathodes at operating temperatures is considerably higher than the thermionic emission measured in vacuum, but still much smaller than the discharge current which they normally pass. It is shown that the various secondary and field emission processes must play a prominent part in the normal operation of these cathodes which, in fact, need not necessarily be particularly good thermionic emitters. A.

COSMIC RAYS 537.591

537.591.15

9253. THE FLUCTUATION PROBLEM IN μ-MESON BURSTS. A.N.Mitra.
Nuclear Physics, Vol. 3, No. 2, 262-72 (April, 1957).

The effect of the fluctuation problem on the size-frequency distribution of large cosmic-ray bursts is investigated in some detail, assuming the μ-meson to be an ordinary Dirac particle. This is achieved with the help of a general distribution function called the Polyá distribution, which reduces to the previously investigated Poisson and Furry cases at appropriate limits. It is found that the fluctuation of the number of shower particles has a considerable influence on the size of cosmic-ray bursts, and this result partially obscures any conclusion that may be made on the spin of the μ-meson with the help of burst-production data. A.

537.591.2

9254. OBSERVATION ON THE ENERGY SPECTRA OF MULTIPLY CHARGED NUCLEI IN THE COSMIC RADIATION. C.J.Waddington.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 737-8 (March, 1957).

Direct energy measurements in a single emulsion stack on 150 α-particles and 52 heavy nuclei ($\bar{Z} = 8$) yield exponents for the integral energy spectra of 1.7 ± 0.2 and 1.2 ± 0.3 ($\bar{Z} > 5$) respectively. The spectra of the various components are probably closely similar, contrary to a recent suggestion of Singer. K.H.Barker

MAGNETISM 538

538.114

9255. APPLICATION OF VARIATIONAL PRINCIPLE TO ISING MODEL OF ANTIFERROMAGNETICS. I.A.Kvasnikov.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 3, 544-7 (1957). In Russian.

Follows the method of a previous paper (Abstr. 4524/1957) on ferromagnetics, the N conditions on the statistical sum over neighbours now being modified to apply to antiferromagnetics. J.W.Gardner

538.114 : 538.221

9256. APPLICATION OF VARIATIONAL PRINCIPLE IN PROBLEMS OF A BINARY ALLOY AND ISING SYSTEM. I.A.Kvasnikov.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 4, 777-9 (1957). In Russian.

The method of previous papers (Abstr. 4524/1957 and preceding abstract) is extended to a binary alloy Ising system. J.W.Gardner

538.22 : 536.48

9257. SPIN—SPIN ABSORPTION IN CHROMIC METHYL AMMONIUM ALUM AND MANGANOUS CHLORIDE TETRAHYDRATE AT VERY LOW TEMPERATURES. E.Ambler and R.P.Hudson.
Physica, Vol. 22, No. 10, 866-8 (Oct., 1956).

Reports results of measurements of the complex susceptibility of the alum below 1 °K and at frequencies 0.1-10 Mc/s and of the chloride between 1° and 4 °K. For the chloride a maximum is observed at 2.3 °K, well above the antiferromagnetic transition temperature. E.P.Wohlfarth

538.221

9258. MAGNETIC DOMAINS IN MANGANESE—ANTIMONY. R.Perthel and W.Andrä.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 265-7 (1956). In German.

For Mn_2Sb dagger-shaped domains were observed parallel and star-shaped ones perpendicular to the tetragonal axis. For MnSb the observed complicated patterns, showing sharply bent domain boundaries, are ascribed to strain effects. E.P.Wohlfarth

538.221 : 539.27

9259. ELECTRON MICROSCOPICAL INVESTIGATION OF MAGNETIC POWDER PATTERNS. W.Schwartze.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 322-8 (1956). In German.

The resolving power of the powder pattern method and the density variation of the powder particles near a domain boundary are discussed. Electron microphotographs of patterns on cobalt are shown. See also Abstr. 7531 (1956). E.P.Wohlfarth

538.221

9260. DIRECTIONAL ORDERING IN IRON—NICKEL ALLOYS. E.T.Ferguson.
C.R. Acad. Sci. (Paris), Vol. 244, No. 19, 2363-6 (May 6, 1957). In French.

Reports results of measurements of the uniaxial anisotropy energy $E(T,t)$ for alloys containing up to 50% Fe and heat-treated for a time t at temperature T in a magnetic field. It is found that $E(T,\infty)$ is proportional to $(\theta - T)$, where θ is the Curie temperature. The dependence of E on Fe content was also studied. E.P.Wohlfarth

538.221

9261. HYPERFREQUENCY PROPERTIES OF SOME NICKEL-ZINC FERRITE CHROMITES. C.Guillaud, R.Vautier and W.Kagan.
C.R. Acad. Sci. (Paris), Vol. 244, No. 23, 2781-4 (June 3, 1957). In French.

Reports results of waveguide measurements of the Faraday rotation and the attenuation of these substances, $Fe_2O_3.Cr_2O_3$. NiO.ZnO, with different relative compositions at a frequency 9.575 kMc/s. Both these factors in general decrease as the Cr_2O_3 content increases. E.P.Wohlfarth

538.221

9262. VARIATION OF THE RESONANCE FIELD IN NICKEL-ZINC FERRITE CHROMITES. R.Vautier and W.Kagan.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3040-3 (June 17, 1957). In French.

See preceding abstract. Both the saturation magnetization and the resonance field decrease as the chromium content increases, contrary to expectation. E.P.Wohlfarth

538.221 : 538.244

9263. THE ANHYSTERETIC REMANENT MAGNETIZATION OF FERRIMAGNETICS. F.Rimbert.
C.R. Acad. Sci. (Paris), Vol. 245, No. 4, 406-8 (July 22, 1957). In French.

Measurements are reported for powders of magnetite dispersed (1%) in clay and for haematite powders, for a range of direct fields up to 500 oersted, and 50 c/s alternating fields up to 800 oersted. The process of demagnetization by the same a.c. methods is also described, and a correspondence between the two processes is established. E.P.Wohlfarth

538.221

9264. FERRIMAGNETIC RESONANCE OF ERBIUM GARNET AT 9.4 kMc/s. J.Paulevé.
C.R. Acad. Sci. (Paris), Vol. 245, No. 4, 408-11 (July 22, 1957). In French.

The resonance field was measured between 4° and 530°K and an anomaly observed at the compensation temperature 84°K. The results are explained by attributing a g factor 5 to the Er ions above 100°K; the low temperature results are inconclusive. E.P.Wohlfarth

538.221 : 548.74

9265. STUDY BY NEUTRON DIFFRACTION AT 4.2°K OF THE ANTIFERROMAGNETIC STRUCTURE OF $FeCl_2$.
A.Herpin and P.Mériel.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 650-3 (Aug. 5, 1957). In French.

Measurement of the intensities of the neutron beams diffracted by $FeCl_2$ at 4.2°K suggests that the Fe atoms in successive planes normal to the c- axis have their magnetic moments antiparallel along the c- axis direction. J.Thewlis

538.221

9266. TEMPERATURE DEPENDENCE OF THE g-FACTOR AND RELAXATION TIME FOR FERROMAGNETIC RESONANCE FOR SOME FERRITES. A.P.Komar and N.I.Krivko.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 1, 64-6 (1957). In Russian.

Measurements are made of the g-factor and the relaxation time, T, from the magnetic resonance curve position and half-widths at 9.4×10^9 Mc/s for a series of ferrites. Typical is 20% Li_2O with 80% Fe_2O_3 for which at 290°K g = 2.03, $T = 5.1 \times 10^{-10}$ sec. and at 4.2°K g = 1.84, $T = 3.8 \times 10^{-10}$ sec. D.H.Whiffen

538.221

9267. THE ANTIFERROMAGNETISM OF MANGANESE COPPER ALLOYS. G.E.Bacon, I.W.Dunmur, J.H.Smith and R.Street.
Proc. Roy. Soc. A, Vol. 241, 223-38 (Aug. 7, 1957).

Manganese-rich γ phase alloys of manganese + copper have been investigated by neutron and X-ray diffraction techniques, and the temperature variations of magnetic susceptibility and electrical resistivity have been measured. The disappearance of long-range antiferromagnetic ordering has been correlated with the face-centred-tetragonal – face-centred-cubic martensitic transformation of these alloys. The Néel temperatures and the magnetic moments of the manganese ions, for alloys of various compositions, have been determined. The Néel temperature increases approximately linearly with increasing manganese content and extrapolates to 660°K at 100% Mn; the value of $1.4 \pm 0.1\mu_B$ has been obtained for the ionic moment of the manganese ions in pure γ-Mn. Experiments on plastically strained specimens show that compressive stress results in alignment of the c axes of the crystallites along the [100]-type direction most nearly parallel to the stress axis. The ionic moments are aligned along the c axis and the susceptibility of plastically strained specimens is anisotropic. An analysis is given of the results of measurements of the anisotropy of susceptibility from which may be calculated $\chi_{\parallel}$ and $\chi_{\perp}$, the susceptibilities of a single antiferromagnetic domain measured respectively parallel and perpendicular to the direction of antiferromagnetism. The results of the investigations are discussed in terms of an electron band model of an antiferromagnetic metal. A.

538.221 : 537.311.32 : 537.226.2 : 621.315.612 : 621.318.12

SOME NEW ELECTRICAL AND MAGNETIC CERAMICS.
See Abstr. 9155

538.222

9268. PRINCIPAL MAGNETIC SUSCEPTIBILITIES OF FERROUS BROMIDE AND IODIDE. H.Bizette, C.Terrier and B.Tsaï.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 507-9 (July 29, 1957). In French.

Reports results up to 300°K of susceptibility measurements made parallel and perpendicular to the principal axes. In both directions the susceptibilities are independent of field strength and an antiferromagnetic transition occurs at 10°K for both substances. The results are discussed in relation to the crystal structure. E.P.Wohlfarth

538.222

9269. PARAMAGNETIC STUDY OF THE FERRITES $5Fe_2O_3,3M_2O_3$ WITH M = Gd, Dy, Er. R.Aléonard and J.C.Barbier.
C.R. Acad. Sci. (Paris), Vol. 245, No. 8, 831-4 (Aug. 19, 1957). In French.

Describes measurements, at temperatures above the Curie point, of the susceptibilities of certain ferrites. The results are discussed in terms of the Néel theory of ferrimagnetism. D.J.Oliver

538.222

9270. PARAMAGNETIC RELAXATION IN POTASSIUM FERRICYANIDE. T.Haseda and E.Kanda.
Physica, Vol. 23, No. 4, 322-4 (April, 1957).

Reports results of measurements of the spin–lattice relaxation time at low temperatures (1.6°-4.2°K) and discusses the results in connection with the magnetic moment of the ferric ion and the existence of covalent binding. E.P.Wohlfarth

538.24

9271. INFLUENCE OF SUCCESSIVE MAGNETIC FIELDS WITH RANDOM AMPLITUDE ON THE MAGNETIZATION OF FERROMAGNETIC SUBSTANCES. L.Néel.
C.R. Acad. Sci. (Paris), Vol. 244, No. 20, 2441-6 (May 13, 1957). In French.

The change of magnetization is calculated by assuming a Gaussian distribution, and application is made to the theory of magnetic viscosity where the random fields are the equivalent fluctuation fields. E.P.Wohlfarth

538.24

9272. SPONTANEOUS MAGNETIZATION IN THE Mn–Ga–C ALLOYS. H.P.Myers.
Canad. J. Phys., Vol. 35, No. 7, 819-22 (July, 1957).

Measurements of spontaneous magnetization, Curie temperature, and lattice parameter have been made on a series of alloys containing 20% (atomic) C and in which the Ga content varied from 10-18%. The results are compared with similar observations on the Mn–Al–C and Mn–Zn–Al–C alloys. A.E.De Barr

538.24

9273. CONCERNING THE MAGNETIZATION OF BODIES IN THE PRESENCE OF MAGNETIC VISCOSITY. M.I.Rozovskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 2, 355-9 (1957). In Russian.

Theoretical paper, using ideas and differential equation due to Arkad'ev. The author puts forward a method of solving the problem of the magnetization of bodies, in particular of a cylinder, suitable for any shape of experimental curve of viscous magnetization. C.R.S.Manders

538.244.1

9274. CALCULATION OF THE INDUCED MAGNETIC MOMENT OF A FERROMAGNETIC ELLIPSOID OF REVOLUTION IN AN ALTERNATING MAGNETIC FIELD. L.A.Gel'bukh.
Zh. tekh. Fiz., Vol. 27, No. 3, 548-59 (1957). In Russian.

Theoretical paper. An approximate method of calculating the induced magnetic moment is put forward for the case of a ferromagnetic ellipsoid of revolution in a homogeneous alternating

magnetic field. Relations are obtained which completely determine the longitudinal and transverse components of the induced moment. For zero frequency of alternation and a long ellipsoid the results reduce to the case of a static field. C.R.S.Manders

538.247

9275. INVESTIGATIONS OF THE INTERNAL DEMAGNETIZING FACTOR. G.Vogler.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 229-32 (1956). In German.

This is measured from the angle of shear of the hysteresis curve for spherical carbonyl iron particles embedded in a non-magnetic medium. The factor depends on the magnitude of the applied field, but tends to be a linearly decreasing function of the iron concentration at high fields. This relation is also derived theoretically for an assembly of plate-shaped particles.
E.P.Wohlfarth

ELECTROMAGNETISM. ELECTRODYNAMICS

538.3/.5

538.3

9276. GENERAL SOLUTIONS OF THE EQUATIONS OF A NON-CONSERVATIVE CLASSICAL ELECTROMAGNETISM. P.Gautier.
C.R. Acad. Sci. (Paris), Vol. 245, No. 1, 45-7 (July 1, 1957). In French.

Formulae are obtained for calculating the electromagnetic field in a medium containing electric and magnetic charges which can not only move but can be created and destroyed. P.M.Davidson

ELECTROMAGNETIC WAVES AND OSCILLATORS 538.56

538.56

9277. ELECTROMAGNETIC POTENTIALS IN A HETEROGENEOUS NON-CONDUCTING MEDIUM. A.Nisbet.
Proc. Roy. Soc. A, Vol. 240, 375-81 (June 11, 1957).

For electromagnetic fields in a stationary non-conducting medium (isotropic or anisotropic), whose dielectric constant and permeability are given point-functions, the general theory of representations in terms of scalar and vector potentials and of Hertzian potentials is developed. Differential equations relating these potentials to the sources of the field are obtained. Special cases are also treated of representations in terms of two scalars satisfying second-order differential equations. This paper contrasts with the author's alternative approach (Abstr. 8927/1955), in which the properties of the medium were introduced through the electric and magnetic polarizations rather than the dielectric constant and permeability, and which led to integro-differential equations. A.

538.56

9278. HERTZIAN ELECTROMAGNETIC POTENTIALS. W.H.McCrea.
Proc. Roy. Soc. A, Vol. 240, 447-57 (July 16, 1957).

The general properties of the Hertzian electromagnetic potentials and their gauge transformations, given by Nisbet (Abstr. 8927/1955), are re-derived in tensor form appropriate to the space-time of special relativity. There appears to be a considerable gain in conciseness and comprehensibility of the general results, although it is recognized that Nisbet's forms may be those suited to particular applications. Whittaker's scalar potentials are briefly considered. The theory refers exclusively to flat space-time because the results require covariant differentiation to be commutative, but it is formulated in terms of any curvilinear coordinates in such space-time. A.

538.566 : 537.525

E.M. WAVES IN PLASMA. See Abstr. 9213-14

538.566.2/.3

9279. THE PROPAGATION OF ELECTROMAGNETIC WAVES IN PLASMA (IONOSPHERE). B.N.Gershman, V.L.Ginzburg and N.G.Denisov.
Uspekhi fiz. Nauk, Vol. 61, No. 4, 561-612 (1957). In Russian.

A review article stressing the common ground of radioastronomy developments and of laboratory studies of plasma. The propagation of e.m. waves in a homogeneous magnetoactive plasma is discussed under "normal" conditions and taking account respectively of the thermal motion of electrons and of ions. Field behaviour is considered for plasma waves and with an inhomogeneous magnetoactive plasma. Wave interaction in the ionosphere, also wave interaction with absorption are dealt with, and finally the polarization of waves emerging from the ionosphere. 73 references (32 Soviet).
C.R.S.Manders

538.566.2

9280. FERMAT'S PRINCIPLE IN NONHOMOGENEOUS ABSORBING MEDIA. F.Cap.
Ann. Inst. Poincaré, Vol. 15, No. 2, 123-31 (1956). In French.

The theory of very-high-frequency electromagnetic waves in a nonhomogeneous medium is studied, to find how absorption terms modify Fermat's principle, which holds in their absence.
P.M.Davidson

538.566.3 : 551.510.535

9281. THE MAGNETO-IONIC THEORY AND ITS RESULTS. D.Lépéchinsky.
Ann. Télécomm., Vol. 12, No. 2, 60-70 (Feb., 1957). In French.

This paper represents Pt I of a detailed theoretical analysis. A new practical method of solving the Appleton–Hartree equation is first given, whereby the parameters of ionospheric propagation (refractive index, absorption index, and wave polarization) are determined. Considerations of the polarization of e.m. waves are also included, and it is shown how the collisional frequency at the base of the ionosphere may be determined by a graphical construction. See also the following abstract. G.M.Brown

538.566.3 : 551.510.535

9282. THE MAGNETO-IONIC THEORY AND ITS RESULTS. D.Lépéchinsky.
Ann. Télécomm., Vol. 12, No. 3, 74-91 (March, 1957). In French.

For Pt I see the preceding abstract. Detailed considerations are given to the effect of quasi-longitudinal (Q.L.) propagation on the conditions of reflection in the ionosphere, and, in particular, the effect of the limiting Q.T. (quasi-transverse) – Q.L. region on vertical soundings. The latter is relevant to the correct determination of electron densities in the E-layer. The influence of the earth's magnetic field on the propagation conditions may also explain the longitude effect in the F-region. The inclination of the earth's magnetic field is also found considerably to influence the determination of absorption in the D-region. G.M.Brown

538.566.3

9283. ON IONOSPHERIC REFLECTION IN THE PRESENCE OF COLLISIONS. P.Poincelot.
C.R. Acad. Sci. (Paris), Vol. 244, No. 18, 2298-9 (April 29, 1957). In French.

Addition to former publications (see Abstr. 8031/1957). The attenuation of a wave reflected from a layer in which the electron density varies exponentially with height is determined, and compared with the case of a linear variation previously considered.
G.M.Brown

538.566.3 : 551.510.535

9284. CERTAIN PROBLEMS OF IONOSPHERIC PHYSICS. I. ELECTRON DENSITY FLUCTUATIONS AND RADIOWAVE SCATTERING. Ya.L.Al'pert.
Uspekhi fiz. Nauk, Vol. 61, No. 3, 423-50 (1957). In Russian.

Survey article discussing such topics as: the effective scattering cross-section of the ionosphere, vertical sounding, the determination of $(\Delta N/N)^2$, the distant propagation of ultra-short waves and its facilitation by scattering, ionospheric turbulence.
C.R.S.Manders

538.56

9285. DIRECTIONAL COUPLER ARRANGEMENT FOR AN ELECTRON PARAMAGNETIC RESONANCE SYSTEM WITH CIRCULARLY POLARIZED WAVES. A.Charru.
C.R. Acad. Sci. (Paris), Vol. 244, No. 16, 2146-7 (April 15, 1957). In French.

Using a quarter-wave section the reflected wave from an electron spin resonance sample cavity is rotated 90° with respect to the input and may therefore be extracted into a rectangular waveguide and amplified without interference from the direct klystron power; the sensitivity is increased by 30. D.H.Whiffen

538.569

9286. ROTATION OF THE PLANE OF POLARIZATION IN A LONGITUDINAL MAGNETIC FIELD (FARADAY EFFECT) IN THE MILLIMETRE WAVEBAND. D.I.Mash.
Zh. tekh. Fiz., Vol. 27, No. 2, 360-3 (1957). In Russian.

The Faraday effect in a large number of ferrites has been measured at millimetre wavelengths. The best specimens had an insertion loss of 0.1 to 0.8 dB and rotations of up to 360° could be obtained depending on dimensions of specimen and strength of magnetic field. J.B.Arthur

MOLECULAR AND ATOMIC STRUCTURE

539.I

THEORY OF SOLID STATE 539.II

539.11

9287. GRÜNEISEN PARAMETERS FOR THE EQUATION OF STATE OF SOLIDS. T.H.K.Barron.
Ann. Phys. (New York), Vol. 1, No. 1, 77-90 (April, 1957).

The value of Gruneisen's parameter γ and its variation with temperature are calculated for some simple crystalline models; for comparison the value of γ_S given by Slater's formula is also calculated ($\gamma_S = \frac{1}{2}d\log(\chi V^{-1/3})/d\log V$, where χ is the compressibility). There is no unique measure of the anharmonicity of a crystal, and in particular there appears to be no interatomic potential that will give a crystal potential energy that is ideally harmonic. For example, a close-packed cubic lattice in which each pair of nearest neighbours interacts with a harmonic potential has a negative thermal expansion, the values of γ at high and low temperatures being $\gamma_\infty \cong -0.44$ and $\gamma_0 \cong -0.74$; on the other hand $\gamma_S = \frac{1}{3}$ for this model. A model representing an ionic crystal of sodium chloride structure with no polarization of the ions gives $\gamma_\infty \cong 1.6$ and $\gamma_0 \cong 1$, while $\gamma_S \cong 2.1$; the values of γ_∞ and γ_0 are lower than much earlier estimates by Born. In the calculation of γ_0, the γ_j corresponding to individual long acoustic waves in different crystal directions are derived, and are found to cover a wide range of values, some of them negative. In both these theoretical models, and also in close packed crystals with more general central forces, γ_S is appreciably larger than γ_∞. Most of the experimental data is uncertain, but it would indicate that, in agreement with theory, $\gamma_S > \gamma_\infty$ for most alkali halides. For metals, on the other hand, a revised interpretation of experimental data given recently by Gilvarry shows that usually $\gamma_S < \gamma_\infty$. An artificial model is put forward as an example of how this might happen. A.

539.11

9288. ON THE SPECIFIC HEAT OF ELECTRONS IN METALS. F.Kaschluhn.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 94-101 (1956). In German.

The low-temperature specific heat C_V of an electron gas is calculated by the author's mean-value method for interacting fermions (Abstr. 98/1956). Two types of interaction are considered, that of Fröhlich (Abstr. 325/1951) which arises in a metal through coupling with the lattice vibrations and the screened Coulomb interaction of Bohm and Pines (Abstr. 1278/1954). The linear dependence of C_V on temperature is not destroyed by the interaction but the coefficient deviates from Sommerfeld's value. For Na it is decreased by about 10% in the case of Fröhlich's interaction and increased by over 30% in the Bohm–Pines' case. The effect of both interactions together is thus expected to raise C_V above the free-electron value in agreement with experiment. Previous methods of including interparticle interaction in specific heat calculations are criticized. D.M.Edwards

539.11

9289. NUCLEAR MAGNETIC RESONANCE AND ELECTRONIC STRUCTURE OF CONDUCTORS. N.Bloembergen.
Canad. J. Phys., Vol. 34, No. 12A, 1299-314 (Dec., 1956).
"Electron transport" Conference paper (see Abstr. 8734/1957).

The information about electron wave-functions and band structures obtainable from nuclear magnetic resonance experiments in conductors is reviewed. The isotropic and anisotropic metallic shift, the relaxation time, isotropic and anisotropic spin exchange coupling, and quadrupole interactions are discussed. The variation of these effects as a function of pressure, temperature, and alloy composition is described. Some recent results for semiconductors and superconductors are included in the discussion. A.

539.11

9290. ON THE SURFACE FREE ENERGY AND SPECIFIC HEAT OF A METAL. R.Stratton.
Phil. Mag. (Eighth Ser.), Vol. 2, 702-4 (May, 1957).

The author's previous calculations (Abstr. 7640/1953, 636/1954) are compared with Montroll's (Abstr. 4034/1950). Some differences of method lead to different numerical factors in the expressions for the surface contributions to the lattice and free-electron specific heats. A correction is made to the author's derivation of the ratio of the surface free energy difference between the superconducting and normal states to the corresponding bulk term (Abstr. 637/1954). D.M.Edwards

539.11

9291. THE ELECTRON–PHONON INTERACTION, ACCORDING TO THE ADIABATIC APPROXIMATION. J.C.Taylor.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 4, 693-7 (1956).

The interaction of conduction electrons with a vibrating metallic lattice has been considered by Ziman in terms of non-adiabatic perturbations to the adiabatic approximation of the Born–Oppenheimer theory (Abstr. 513/1956). This programme is continued to calculate the self-energy of the electrons. When account is taken of the dependence of the energy levels of the adiabatic Hamiltonian itself upon the electron configuration, the final result is the same as the standard one. A.

539.11

9292. THE BAND STRUCTURE OF ALUMINIUM. I. DETERMINATION FROM EXPERIMENTAL DATA. V.Heine.
Proc. Roy. Soc. A, Vol. 240, 340-53 (June 11, 1957).

The band structure and particularly the shape of the Fermi surface are deduced mainly from the available experimental data on the de Haas–van Alphen and anomalous skin effects, and from the low-temperature specific heat. Since these data are rather incomplete, it is found necessary to use in conjunction with them a theoretical band-structure calculation, which, however, unavoidably contains rough approximations. Except near the surface of the Brillouin zone, E(k) is found to be very close to the free-electron energy. The first zone is found to contain 3.6×10^{-3} holes per atom around the zone corners. There is overflow of electrons into the second zone across all the zone faces, and these regions of the Fermi distribution are joined together near the centres of the zone edges; the third zone contains a very small number of electrons. A.

539.11

9293. THE BAND STRUCTURE OF ALUMINIUM. II. THE CONVERGENCE OF THE ORTHOGONALIZED PLANE WAVE METHOD. V.Heine.
Proc. Roy. Soc. A, Vol. 240, 354-60 (June 11, 1957).

Herman (1954) has found poor convergence of the secular equation in the orthogonal plane-wave method of calculating band structures. It is shown that the convergence depends critically on the choice of the atomic-like functions ϕ_t used in this method. A particular choice gives much better convergence, and also results in an exact formulation of the method that is nevertheless very simple. These two advantages, together with the rather general form assumed for the potential, have rendered the method much more useful than previous experience has indicated. A.

539.11

9294. THE BAND STRUCTURE OF ALUMINIUM. III. A SELF-CONSISTENT CALCULATION. V.Heine.
Proc. Roy. Soc. A, Vol. 240, 361-74 (June 11, 1957).

The main feature of the present recalculation of the band structure is a careful consideration of the potential on which it is based. An effective potential acting on a conduction electron is defined intuitively so as to include the effects of correlation and exchange. This grafts the Bohm and Pines theory of a free-electron gas (Pines 1955) on to the Hartree–Fock treatment of the effect of the ion cores. Correlation and exchange effects among the conduction and ion-core electrons have been calculated, and the variation of the potential in the regions about half-way between the atoms has also been calculated and taken into account. Achieving self-consistency in the contribution to the potential due to the conduction electrons has not been difficult. Because of various approximations, including those in the potential, the calculated energy values are judged to be correct to about 0.03 ry. The results are found to agree satisfactorily with the model of the band structure obtained in Pt I by noting that the effective Fermi level for electrons and holes in the band structure may not be the same due to additional correlation effects. A.

MOLECULES 539.13

539.13

9295. A METHOD FOR THE DETERMINATION OF COLLISION-INDUCED VIBRATIONAL TRANSITION PROBABILITIES, WITH RESULTS FOR $N_2(B^3\Pi_g)-N_2$ COLLISIONS. C.R.Stanley.
Proc. Roy. Soc. A, Vol. 241, 180-93 (Aug. 7, 1957).

Certain intensity changes arising in the spectrum of the nitrogen afterglow are attributed to collisional energy exchanges between the molecules. A method is described by which the probabilities of such exchanges can be derived from precise measurements of the intensity variations. For $N_2(B^3\Pi_g)-N_2$ collisions, the probability of a vibrational transition is found to be of the order of 10^{-2} per gas-kinetic collision. A.

539.132

9296. ON THE QUESTION OF STATIONARY OSCILLATION OF A SIMPLE MACROMOLECULAR MODEL IN A FLOWING MEDIUM. H.Müller.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 304-8 (1956). In German.

It is shown how for a simple model of a macromolecule oscillating in a flowing medium the expression

$$\int dE_V + \int dE_{kin}$$

assumes minimum values (dE_V is the viscous heating in time dt, dE_{kin} is the kinetic energy). T.C.Toye

539.132 : 539.185

9297. ESTIMATION OF THE POTENTIAL BARRIER HEIGHT OF TORSIONAL ROTATION IN CH_3SH MOLECULES BY MEANS OF SLOW-NEUTRON SCATTERING. A.Budzanowski, K.Grotowski, J.A Janik, F.Maniawski, H.Rżany, A.Szkatuła and A Wanic.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 3, 295-7 (1957).

A Ra–Be neutron source was used, the neutrons being thermalized by paraffin wax in the usual fashion. A multi-plate, argon-filled ionization chamber, with boron-coated electrodes, was employed as a detector. Liquid CH_3SH was enclosed in a flat-walled brass vessel and water was used as a reference substance with an assumed cross-section of 91 barns. The scattering cross-section obtained for CH_3SH was 194.1 ± 5 barns. The value for the potential barrier height of torsional rotation works out at 700 or 1000 cal/mole according to the assumptions made, i.e. it is much lower than the value (1460) obtained from the thermodynamic data. J.Thewlis

539.132

9298. PERTURBATION AT v = 6 OF THE $A^1\Pi$ STATE OF CO. R.Onaka.
J. chem. Phys., Vol. 26, No. 6, 1763-4 (June, 1957).

The fourth positive bands $A\,^1\Pi \rightarrow X\,^1\Sigma^+$ of CO were photographed on a vacuum grating spectrograph of high dispersion (3.3-3.8 mm/A) and results confirm perturbation of P(R) and Q branches by the overlapping states $d^3\Pi$(v = 11) and a $^3\Sigma^+$(v = 17). There is also evidence of perturbation by another electronic state which is either Π or Δ. R.C.Seymour

539.132

9299. NORMAL FREQUENCIES OF OCTAHEDRAL $M(XY)_6$ MOLECULES. H.Murata and K.Kawai.
J. chem. Phys., Vol. 27, No. 2, 605 (Aug., 1957).

Theoretical expressions are given for the F and G matrix elements, and used to calculate the fundamental vibration frequencies for $Cr(CO)_6$ and $Mo(CO)_6$, the results being in good agreement with experiments reported in Abstr. 1982 (1956). J.Hawgood

539.132

9300. EXCITATION ENERGIES OF ETHYLENE. W.Kołos.
J. chem. Phys., Vol. 27, No. 2, 591-2 (Aug., 1957).

Correlation between electrons of opposite spin is estimated by multiplying the usual orbital wave-function by the interelectron distance. Approximate results for energies of singlet states in ethylene agree well with experiment. J.Hawgood

539.132

9301. EXCITATION ENERGIES OF BENZENE. W.Kołos.
J. chem. Phys., Vol. 27, No. 2, 592 (Aug., 1957).

The method of the preceding abstract is applied to benzene, correcting only for the interaction of electrons of opposite spin belonging to the same orbital pair. Agreement with experiment is reasonable. J.Hawgood

539.132

9302. ANOMALOUS TEMPERATURE DEPENDENCE OF THE SPIN–LATTICE RELAXATION TIME IN FERROCENE. C.H.Holm and J.A.Ibers.
J. chem. Phys., Vol. 26, No. 6, 1753 (June, 1957).

From 300-190°K ferrocene gave a proton resonance spectrum measured at 16 Mc/s with a second moment 1.6 gauss^2 indicating no reorientation of the cyclopentadienyl rings. From 190-110°K the signal to noise ratio increases anomalously by a factor of 10 and it is probable that T_1 is much reduced by an electron transfer process in this range. The isomorphous nickelocene, which is paramagnetic, has the low T_1 at all temperatures. D.H.Whiffen

539.132

9303. LINE WIDTH OF THE PURE QUADRUPOLE RESONANCE OF BROMINE IN $KBrO_3$. Y.Kôi, A.Tsujimura and Y.Imaeda.
J. chem. Phys., Vol. 27, No. 2, 603-4 (Aug., 1957).

Techniques previously applied to $NaBrO_3$ (Abstr. 8131/1955, 4630/1957) are applied to $KBrO_3$, for which the dipolar contribution to the line-width may be calculated by the theory of Abragam and Kambe (Abstr. 7841/1953). This contribution is shown to be small compared to the observed width, which is larger for Br^{79} than for Br^{81} despite the latter's larger magnetic moment. The width is ascribed mainly to crystal strain. J.Hawgood

539.132

9304. BOND ENERGY IN CaOH AND SrOH MOLECULES. I.V.Veits and L.V.Gurvich.
Optika i Spektrosk., Vol. 2, No. 2, 274-6 (1957). In Russian.

From spectroscopic data and on the justifiable assumption that, in flames, the partial pressure of CaOH and SrOH is only 0.2 or less of the partial pressure of CaO and SrO, it is calculated that the bond energy of Ca–OH is 95 ± 10 kcal/mole and that of Sr–OH is 90 ± 10 kcal/mole, in good agreement with the approximate value of 109 kcal/mole found for the energy of the Be–OH bond by Grossweiner and Seifert (J. Amer. Chem. Soc., Vol. 74, 2701, 1952). R.C.Murray

539.132 : 539.153.4

9305. THE DENSITY MATRIX IN SELF-CONSISTENT FIELD THEORY. III. GENERALIZATIONS OF THE THEORY. R.McWeeny.
Proc. Roy. Soc. A, Vol. 241, 239-56 (Aug. 7, 1957).

The self-consistent field theory of Pt I and II (Abstr. 6416/1957) is generalized so as to apply to a system in which some orbitals are doubly occupied and others singly. Starting from an initial approximation, the density matrices for both the closed shell and the "open" shell are simultaneously improved by an iterative method until self-consistency is achieved. A second generalization deals with the case in which several shells can profitably be distinguished, not by a difference of orbital occupation numbers but by virtue of their weak coupling (e.g. the atomic K, L, M shells of argon). In this case it is best to consider each shell individually (their number and type now being unrestricted), achieving approximate self-consistency in one shell at a time. The nature of the solutions is discussed. In cases of high symmetry, degeneracy occurs and a single determinant is not an acceptable state function; at the same time the self-consistent solution has awkward symmetry properties. This latter difficulty can be avoided with only slight loss of accuracy by applying suitable constraints. And the wider use of constraints, as a means of facilitating solution, is discussed. Finally, it is shown how having obtained self-consistent density matrices, the orbitals themselves may be extracted in readiness for a configuration interaction calculation; and the degenerate case, in which interaction is essential, is briefly discussed. A

539.132 : 538.113

9306. CALCULATION OF THE ANISOTROPY OF THE DIAMAGNETIC SUSCEPTIBILITY OF AROMATIC MOLECULES BY THE METHOD OF THE METALLIC MODEL FOR MOLECULES. T.K.Rebane.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 1, 70-2 (1957). In Russian.

The metallic model for aromatic molecules leads to diamagnetic susceptibility anisotropies in as good agreement with the observed as that given by a full molecular orbital treatment. D.H.Whiffen

539.133 : 535.343

STRUCTURE OF $(CH_3)_3$ CCN. See Abstr. 9088

ATOMS. NUCLEUS. ISOTOPES 539.15

539.152.1

9307. ON THE SIGN OF THE REAL CENTRAL PART OF THE NEUTRON–NUCLEUS COMPLEX POTENTIAL. A.Kind.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 318-20 (Jan., 1957).

Arguments are presented that the sign of the real central part of the complex potential which describes the neutron–nucleus interaction may be negative for neutron energies greater than 300 MeV. L.L.Green

539.152.1

9308. A NOTE ON THE CALCULATION OF COULOMB PENETRATION AND COULOMB WAVE FUNCTIONS.
R.M.Thaler and L.C.Biedenharn.
Nuclear Physics, Vol. 3, No. 2, 207-12 (April, 1957).

The phase-amplitude method is applied to the calculation of Coulomb penetration and Coulomb wave-functions. The methods discussed apply for $\eta = Z_1 Z_1 e^2/\hbar v > 1$. A.

539.152.1

9309. THE DIPOLE SUM RULE WITH AN APPROXIMATE HAMILTONIAN. J.S.Levinger, N.Austern and P.Morrison.
Nuclear Physics, Vol. 3, No. 3, 456-64 (May, 1957).

The familiar f sum rule for the electric dipole interaction of a complex charge-current system with the electromagnetic field is known to be simply applicable even when exchange forces and other non-classical dynamical effects are present. Evaluation of the f sum for absorption from the ground state can be made knowing only the Hamiltonian and the ground state wave-function. For complex systems the exact wave-function is rarely known. Two methods of estimating the f sum are then attractive whenever an independent particle model is empirically favoured: (i) use of the best I.P.M. wave-functions and the true Hamiltonian, or (ii) use of the same wave-functions but the equivalent one-body potential found to give best energy levels for the I.P.M. In the first calculation, dynamical correlations are neglected; in the second, a spurious contribution to the sum arises from the velocity dependent form typical of an equivalent one-body potential. The f sum is computed by both methods in a nuclear example. The results show the differences of principle which arise, though the numerical agreement is rather close. Physical arguments are given for the origin of this close agreement, which can be expected only in particular cases. No criterion for the reliability of such I.P.M. sum rule calculations is known. A.

539.152.1

9310. NOTES ON THE ACCURACY OF SOME CALCULATIONS CONCERNING THE DEUTERON PROBLEM.
E.K.Euranto and J.Koukila.
Ann. Univ. Turku A, No. 22, 14 pp. (1956).

Previous calculations by the variational method for determining the eigenfunctions of the deuteron with various nuclear potentials have been checked using an integral theorem of Hulthen. A comparison is made with the numerical results obtained by Feshbach and Schwinger (Abstr. 74/1952). L.L.Green

539.152.1

9311. NUCLEAR SURFACES AND ZERO-ENERGY SCATTERING. D.C.Peaslee.
Nuclear Physics, Vol. 3, No. 2, 255-61 (April, 1957).

The assumption of a diffuse nuclear edge introduces computational difficulties in optical model calculations. An approximation procedure is discussed for this case, in which the diffuse edge is replaced by an infinitesimally thin "effective edge" with appropriate reflection and transmission coefficients. Illustration is made with zero-energy neutron scattering, where the parameters $\langle \Gamma_n/D \rangle$ and $\langle a - R \rangle$ are both multiplied by the same factor T for any shape of diffuse edge. The empirical value is $T \cong 2$, corresponding to a total edge "width" of order 2×10^{-13} cm. A.

539.152.1

9312. STUDIES IN THE α-PARTICLE MODEL OF NUCLEI. IV. THE POLARISATION FORCES BETWEEN α-CLUSTERS IN NUCLEI. A.Herzenberg and A.S.Roberts.
Nuclear Physics, Vol. 3, No. 2, 314-35 (April, 1957).

For Pt III, see Abstr. 7286/1957. The polarization forces between α-particles are calculated for central forces between nucleons. There are two distinct possibilities to consider. The first is that the nuclear potential does not contain a direct part, when the polarization energy is the only source of an attraction between α-particles. The Rosenfeld mixture is treated as an example of such a potential, and it is shown that the polarization energy due to this potential is too small to account for the attraction required by the α-particle model. The second possibility to consider is that the nuclear potential does contain a direct part, which is assumed to be attractive, when there is a direct attraction between α-particles (analogous to the attraction between oppositely charged ions) which the polarization forces supplement. The Serber potential is treated as an example of a potential with a direct part, and it is shown that the polarization forces due to this potential cannot play more than a minor role in the attraction between α-particles; however, the magnitude of the polarization energy is not negligible, and is of the order of the α–α binding energy per pair of nearest neighbours in the α-nuclei. The distortion of α-particles to which polarization gives rise may be interpreted as a tendency for the α-particles to dissolve. The probability of solution is estimated, and is shown to be small for $A \leq 40$ even if polarization does provide most of the attraction between α-particles, perhaps through the action of tensor forces. A.

539.152.1

9313. THE PROBLEM OF AN EFFECTIVE MASS IN NUCLEAR MATTER. V.F.Weisskopf.
Nuclear Physics, Vol. 3, No. 3, 423-32 (May, 1957).

It is shown that the existence of nuclear matter and the independent particle description of its properties implies by itself that the average potential energy is momentum dependent. If this momentum dependence is expressed in terms of an effective mass m^*, one gets $m/m^* = 3/2 + (5/2)(P/T_f)$, where P is the packing fraction and T_f the Fermi kinetic energy. The Van Vleck calculation of the average potential energy in the independent particle model is discussed as an example. The photonuclear effect is discussed in terms of a velocity dependent potential. A.

539.152.1

9314. ONE-DIMENSIONAL NUCLEON–NUCLEAR WALL MODEL. D.M.Chase.
Phys. Rev., Vol. 107, No. 3, 805-19 (Aug. 1, 1957).

A one-dimensional system of a particle interacting with a dynamic potential well is studied as a primitive analogue, with regard to methods and results, for more realistic three-dimensional models. A δ-function approximation (linear in the deformation) to the interaction leads to an unnormalizable wave-function and negatively infinite eigenenergies for levels of the ground-state nucleonic band when a certain parameter of the system exceeds unity. Results of numerical computations of eigenenergies by the following approximation methods are given and compared: (1) adiabatic Born–Oppenheimer, (2) static Rainwater, (3) no-recoil, single-exciton Tamm–Dancoff, (4) energy-shell, t_m-exciton Tamm–Dancoff. Of these, the first is based on the "true" interaction, the last three on the δ-function. The no-recoil, unlike the energy-shell, procedure is capable of yielding a reasonable approximation to eigenenergies of the true interaction for the ground-state band in spite of the divergence. Eigenenergies of a higher band computed by method (4) as functions of coupling strength and of t_m for $t_m \leq 4$ converge rapidly but are less depressed by the interaction than those computed by (1). Scattering of the particle by the well is similarly investigated by (1) distorted-wave Born, (2) adiabatic and (3) energy-shell Tamm–Dancoff approximations. From numerical computations, resonances through quasi-bound intermediate states are found to dominate the energy dependence of cross-sections except at very weak coupling, so that the Born and adiabatic approximations are unsatisfactory. The single-level Breit–Wigner formula is shown to be unsuitable for describing these resonances when inelastic channels are open. The single-particle level structure of the potential well modulates the resonances, and single-particle anti-resonances suppress the effect of intermediate states of lower particle energy, influencing convergence with respect to the number of wall excitons included, t_m. Qualitative inferences are made concerning three-dimensional models involving collective nuclear motion. A.

539.152.1

9315. ON NUCLEAR SATURATION. W.Macke.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 89-93 (1956). In German.

Possible characteristics of nuclear forces which can lead to nuclear saturation are discussed. Through an elementary calculation it is shown that the hard core cannot give, by itself, saturation, which requires many-body forces of a certain type. G.E.Brown

539.152.1 : 539.172.13

9316. MEASUREMENT OF THE (p,n) THRESHOLDS OF THE ISOTOPES OF MOLYBDENUM, COMPLETING THE SYSTEMATICS OF THE MASS DIFFERENCES OF THE ISOBARS OF MOLYBDENUM AND TECHNETIUM. C.Latapie, C.Lévi, L.Papineau and N.Saunier.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 672-5 (Aug. 5, 1957).
In French.

The measurements (see Abstr. 7338/1957) complete the data on the binding energy of the last neutron in molybdenum. There are indications of the regular filling and marked closing of the d 5/2 shell and of a difference, greater than 1 MeV, between the d 5/2 and g 7/2 particle levels. W.O.Lock

539.152.1

9317. THE COULOMB EXCITATION OF U^{235}, Pu^{239}, AND U^{238}. J.O.Newton.
Nuclear Physics, Vol. 3, No. 3, 345-63 (May, 1957).

Gamma-rays from the Coulomb excitation of U^{235}, Pu^{239} and U^{238} have been observed with a xenon filled proportional counter. Energies of 46.23 ± 0.2, 56.74 ± 0.3 and 103.2 ± 1 keV with U^{235}, 49.6 ± 0.3 and 57.5 ± 0.3 keV with Pu^{239} and 44.7 ± 0.2 keV with U^{238} were obtained. The gamma-rays are interpreted as arising from the decay of rotational states. From the absolute cross-sections and from the branching ratios of the gamma-rays from the second rotational states the reduced transition probabilities B_{E2} and intrinsic quadrupole moments Q_0 were estimated. Mean values for Q_0 of 10.1, 9.2 and 10.3 barns were obtained for U^{235}, Pu^{239} and U^{238} respectively. Possible assignments of single particle states in a deformed potential to the ground states of U^{235} and Pu^{239} are discussed. A.

539.152.1

9318. THE INFLUENCE OF l-FORBIDDENNESS ON MAGNETIC DIPOLE TRANSITIONS IN Tl^{203}. T.Lindqvist and I.Marklund.
Nuclear Physics, Vol. 3, No. 3, 367-74 (May, 1957).

The angular correlation of the 400 keV-279 keV cascade in Tl^{203} has been measured. The correlation function has the form $w(\theta) = 1-(0.205 \pm 0.005)\cos^2\theta$. A comparison between the mixing ratio of the 400 keV transition ($d_{5/2} \rightarrow d_{3/2}$) and the mixing ratio of the 279 keV transition ($d_{3/2} \rightarrow s_{1/2}$) is made. The l-forbidden M1 transition is retarded by a factor of 1.3×10^{-3} compared to the l-allowed M1 transition. A.

539.152.1 : 539.172.13

9319. MEASUREMENTS OF PROTON STRENGTH FUNCTIONS. J.P.Schiffer and L.L.Lee, Jr.
Phys. Rev., Vol. 107, No. 2, 640-1 (July 15, 1957).

The thick target yield from (p,n) reactions was measured for proton energies up to 4 MeV for a number of elements with A between 37 and 133. From this yield the strength function is evaluated and shows evidence for a maximum around A = 70. See following abstract. M.A.Grace

539.152.1

9320. PROTON-WIDTH STRENGTH FUNCTION. B.Margolis and V.F.Weisskopf.
Phys. Rev., Vol. 107, No. 2, 641 (July 15, 1957).

The maximum in the strength function Γ/D which occurs for neutrons at a mass number A of about 55 is expected to occur for protons at A of about 68. This displacement arises from the difference between the neutron and proton well depths and the influence of Coulomb forces. See preceding abstract. M.A.Grace

539.152.1

9321. DOUBLE COULOMB EXCITATION IN THE SCATTERING OF NUCLEI BY NUCLEI. W.Zickendraht.
Z. Phys., Vol. 148, No. 4, 533-50 (1957). In German.

In the collision of two heavy nuclei there exists the possibility of a mutual excitation of both through their electric interaction. The probability of these processes is calculated by extending the methods of Alder and Winther for simple excitation. The cross-section for the mutual excitation can become as large as 50 mb at energies of ~ 100 MeV for medium weight nuclei. G.E.Brown

539.152.1

9322. COULOMB EXCITATION OF OSMIUM. R.Barloutaud, P.Lehmann and A.Lévêque.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 523-6 (July 29, 1957).
In French.

The experiment shows up the lower 2+ levels in Os^{188}, Os^{190}, and Os^{192}. The results are collated with the available information about radioactive transitions producing these nuclides. J.M.Cassels

539.152.1

9323. ON A DETERMINATION OF THE CHARACTERISTIC PARAMETERS OF A NUCLEAR RESONANCE LEVEL. I. S.Watanabe.
An. Acad. Brasil. Ciênc., Vol. 28, No. 3, 243-51; No. 4, 405-12 (1956). In Portuguese.

Rules are deduced which give directly the values of the orbital and total angular momentum and of the energy of a resonance level from knowledge of the energy variation of the differential cross-section and of the polarization, for the specific case of elastic scattering of particles of spin $\frac{1}{2}$ by a nucleus of spin zero in the energy region 0.1-5 MeV Application is made to the analysis of the 0.461 MeV level of N^{13} formed in the scattering of protons by C^{12}. L.Pincherle

539.152.1

9324. THE EXCITED STATES OF C^{13}. R.R.Roy, A.Lagasse, M.L.Goes, R.Achari and A.de Henau.
C.R. Acad. Sci. (Paris), Vol. 244, No. 24, 2907-9 (June 12, 1957).
In French.

The excited states of C^{13} have been observed by studying the reaction $B^{10}(\alpha,p)C^{13}$ using a diffusion cloud-chamber. Five new excited states are reported. L.L.Green

539.152.1 : 539.163

9325. EXCITED LEVELS IN Hg^{200} STUDIED FROM THE DECAY OF Tl^{200}. C.J.Herrlander and T.R.Gerholm.
Nuclear Physics, Vol. 3, No. 2, 161-84 (April, 1957).

The half-life of Tl^{200} has been found to be (26.1 ± 0.4) hr. Conversion lines corresponding to 14 transitions in Hg^{200} were found. In addition, a few unidentified conversion lines were also observed. With the aid of coincidence spectrometer measurements, a level scheme was established, including the following excited levels: 368.0, 947.4, 1574.8, 1594.9, 1659.6, 1732.3, 1776.0, 1884.7 and 2136.7 keV. Conversion coefficients and K/L ratios were measured. The 368 and 579 keV transitions were found to be pure E2 transitions, suggesting the assignments 2+ and 4+ for the two first excited levels. For most of the other transitions in the decay scheme multipolarity assignments are discussed. A weak positron spectrum was also found in the decay of Tl^{200}, probably consisting of three components going to the ground-state and the two first excited level. The log ft values of the two most energetic transitions are found to be 9.1 and 7.8, consistent with first forbidden transitions. The ground-state of Tl^{200} is 2–, and the mass excess, as calculated from the data, is (34550 ± 3020) μMU. Finally, the level scheme is compared with the results obtained by Adyasevich et al. in neutron-capture experiments on mercury. A.

539.152.1

9326. ROTATIONAL LEVELS OF A NUCLEUS WITHOUT A SYMMETRY AXIS. C.Marty.
Nuclear Physics, Vol. 3, No. 2, 193-6 (April, 1957). In French.

The rotational energy levels of nuclei without a well-defined symmetry axis are discussed. The level scheme for an even–even nucleus without a symmetry axis is described. L.L.Green

539.152.1

9327. A NOTE ON ROTATIONAL ENERGY LEVELS IN NUCLEI. F.Villars.
Nuclear Physics, Vol. 3, No. 2, 240-54 (April, 1957).

It is shown that the kinetic energy T of any system of interacting particles may be written in a "canonical form", which displays the dependence of T on the total angular momentum. A formula is given for the zero order moments of inertia associated with collective rotation of the system. The formalism is applied to nuclei, and for purposes of comparison, to molecules. In addition, it is shown that an unsymmetric formulation of the many particle problem, in which only the nucleons of a "core" participate in the definition of the body fixed axes, leads to a Hamiltonian which is related by a simple averaging process with the "unified" model of Bohr and Mottelson. Finally, a connection is established between the "unified" model of Bohr–Mottelson and the "cranking model" of Inglis.

539.152.1

9328. THE ENERGY LEVELS OF Hf^{177} AND THE UNIFIED MODEL. S.Ofer.
Nuclear Physics, Vol. 3, No. 3, 479-90 (May, 1957).

A study of the γ-ray transitions between levels of Hf^{177} resulting from the β-decay of Lu^{177} has been made using fast–slow coincidence technique. The results and the proposed spin and parity assignments are discussed in the light of the unified model. A value of 0.2 is derived for the gyromagnetic ratio associated with the collective rotational motion.

539.152.1

9329. EXCITED STATES IN THE PROTON $f_{7/2}$ SHELL.
R.D.Lawson and J.L.Uretsky.
Phys. Rev., Vol 106, No. 6, 1369-70 (June 15, 1957).

The excitation energies for the configuration $(f_{7/2})^{-2}$ as given by (pp') experiments on Fe^{54} are used to compute the energy splittings for $(f_{7/2})^{\pm 3}$ and $(f_{7/2})^{4}$. A comparison with some experimental data for Ti^{50}, Cr^{52}, V^{51} and Mn^{51} is presented. L.L.Green

539.152.1

9330. ENERGIES OF $f^{n}_{7/2}$ NUCLEAR CONFIGURATIONS.
I.Talmi.
Phys. Rev., Vol. 107, No. 1, 326-7 (July 1, 1957).

An analysis of energies of excited states of neutron configurations in the $f_{7/2}$ shell has been carried out. L.L.Green

539.152.1

9331. ELECTRIC MONOPOLE TRANSITIONS IN NUCLEI WITH ODD ATOMIC WEIGHT. L.K.Peker and L.A.Sliv.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 621-2 (1957). In Russian.

The existence of E0 transitions from $\frac{1}{2}\pm$ to $\frac{1}{2}\pm$ levels in nuclei of odd A is pointed out, and Au^{197} is discussed as an example. W.O.Lock

539.152.1

9332. THE FIRST EXCITED STATES OF NEON 19.
R.Barloutaud, P.Lehmann, A.Levèque, G.C.Phillips and J.Quidort.
C.R. Acad. Sci. (Paris), Vol. 245, No. 4, 422-4 (July 22, 1957).
In French.

The n–γ coincidences were measured for the reaction $F^{19}(p,n)Ne^{19}$; the half-lives of the 242 and 282 keV levels of Ne^{19} were $(1.8 \pm 0.2) \times 10^{-8}$ and $< 5 \times 10^{-9}$ sec. A.O.Stanesby

539.152.1

9333. CONCERNING LIFETIMES OF LOW ENERGY E1 GAMMA TRANSITIONS IN ODD MASS SPHEROIDAL NUCLEI.
D.Strominger and J.O.Rasmussen.
Nuclear Physics, Vol. 3, No. 2, 197-206 (April, 1957).

A compilation of lifetime measurement data on low energy E1 transitions in odd-proton nuclei of the actinide region is given, and comparison is made with the single-particle lifetime formula. The comparison often shows a retardation of several orders of magnitude. Theoretical E1 matrix elements are calculated using Nilsson's spheroidal-well nucleon wave-functions. The results show without exception a large retardation from the single-particle matrix elements. The selection rules in both the N, l, j, Ω representation and the N, n_z, Λ, Ω representation are considered. Quite generally in either representation selection rules forbid the combination of the large components of the wave-functions with one another, and the various contributions of the small components to the E1 matrix element tend to cancel one another. A.

539.152.2

9334. PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE OF Np^{239}.
M.Abraham, C.D.Jeffries, R.W.Kedzie and J.C.Wallmann.
Phys. Rev., Vol. 106, No. 6, 1357-8 (June 15, 1957).

The spin of Np^{239} was determined by studying the paramagnetic resonance hyperfine structure. The result is that for Np^{239}, $I = \frac{1}{2}$ in agreement with the value obtained from optical hyperfine structure. L.L.Green

539.152.2

9335. HETERODYNE DETECTION OF FREE PRECESSION IN NUCLEAR MAGNETIC RESONANCE. H.Benoît and R.Klein.
C.R. Acad. Sci. (Paris), Vol. 245, No. 2, 155-7 (July 8, 1957).
In French.

A nuclear-resonance signal is observed with a receiver tuned to a frequency slightly different from that of the generator at 8.05 Mc/s. With 50 c/s field modulation beat signals can be observed with good sensitivity. D.H.Whiffen

539.152.2 : 539.132

9336. HIGH RESOLUTION PROTON MAGNETIC RESONANCE IN WATER AND THE CONCEPT OF HYDROGEN BONDING.
R.A.Ogg.
Helv. phys. Acta, Vol. 30, No. 1, 89-90 (1957).

N.m.r. spectra of water vapour at 30 Mc/s show a shift of 150 c/s to higher magnetic fields relative to the liquid. D.H.Whiffen

539.152.2 : 532.77

9337. ELECTROSTATICALLY INDUCED SHIFTS OF NUCLEAR MAGNETIC PROTON RESONANCE LINES IN DILUTE POLAR LIQUIDS. P.Diehl.
Helv. phys. Acta, Vol. 30, No. 1, 91-2 (1957). In German.

Demonstrates the change of the proton magnetic resonance frequency of the -OH group with dilution of C_2H_5OH and CH_3OH in benzene and with dilution of H_2O in dioxan. Shifts of the order of 50 c/s in 32.4 Mc/s observed on dilution indicate appreciable increase of charge density near the proton. D.H.Whiffen

539.152.2

9338. DEPENDENCE OF THE AMPLITUDE OF THE FIRST HARMONIC OF A NUCLEAR MAGNETIC RESONANCE ABSORPTION SIGNAL ON THE AMOUNT OF DETUNING.
I.S.Shpigel', M.D.Raĭzer and É.A.Myaé.
Zh. tekh. Fiz., Vol. 27, No. 2, 351-4 (1957). In Russian.

A theoretical discussion of the dependence of the harmonic signal on frequency, field amplitude, circuit Q factors, etc., in nuclear magnetic resonance absorption. D.H.Whiffen

539.153.4 : 539.165

9339. DETERMINATION OF THE ELECTRONIC WAVE-FUNCTION AND DENSITY OF BERYLLIUM IN ITS VARIOUS PHYSICAL AND CHEMICAL STATES. APPLICATION TO THE VARIATION OF THE CAPTURE HALF-LIFE OF Be^{7}. R.Jacques.
Cahiers de Phys., No. 70, 1-30 (June); No. 71-72, 23-46 (July-Aug.); No. 75-76, 17-32 (Nov.-Dec., 1956). In French.

The wave-function for metallic Be was calculated by three methods: (i) orthogonal plane wave; (ii) which is (i) modified by a variational parameter adjusted to minimize the total energy of the electrons; (iii) direct solution of the Hartree–Fock equation, which gives an electronic density (and half-life) 3.5×10^{-3} less than for the gaseous state. The errors of the three methods are discussed, and the energy of cohesion, intensity and shape of the X-ray spectrum, maximum energy of the quanta emitted, and energy of extraction are also calculated. An approximate statistical method, based on the Thomas–Fermi–Dirac equation with a correction near the nucleus gives the electron density of Be compounds; the variation is comparable with experiment but much too large because of the approximations. A.O.Stanesby

539.153.4 : 535.332

9340. THE STEP-BY-STEP EXCITATION OF ATOMS.
K.I.Rozgachev and V.A.Fabrikant.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 3, 528-9 (1957). In Russian.

Using a tube of Hanle and Schaffernicht pattern (Ann. Phys. Vol. 6, 905, 1930) the Hg triplet (5461, 4358, 4047 A) was excited by electron collision, the radiation being recorded both photographically and by a 13-stage photomultiplier. Pressure in the tube was raised to 0.5-1 mm Hg. A curve is given for the 5461 A line for photocurrent v. electron energy which shows the stepped effect for energies below 7.73 eV, the excitation potential. C.R.S.Manders

539.153.4

9341. PARAMAGNETIC RESONANCE AT VERY LOW FREQUENCIES. R.Beeler and D.Roux.
Helv. phys. Acta, Vol. 30, No. 2-3, 216-20 (1957). In French.

Observation of the electron resonance spectrum of Na in liquid NH_3 at 60-240 kc/s. The shapes are in agreement with theory with a relaxation time of 2.34×10^{-6} sec. D.H.Whiffen

539.153.4

9342. ON THE ATOM FORM FACTOR FOR FREE POSITIVE IONS BASED ON THE THOMAS–FERMI THEORY.
M.Majewski and T.Tietz.
J. chem. Phys., Vol. 26, No. 6, 1772-3 (June, 1957).

It is shown that this factor f_0 can be calculated analytically using an approximate solution of the Thomas–Fermi equation. An application to Cs shows that the f_0-curve calculated by this method for Cs+ oscillates about the curves calculated numerically for neutral Cs. L.Pincherle

539.153.4 : 539.154.2

9343. ON THE RELATIONSHIP BETWEEN Z AND THE ATOMIC DISTRIBUTION OF ELECTRONS. V.M.Klechkovskiĭ.
Optika i Spektrosk., Vol. 2, No. 1, 3-9 (1957). In Russian.

On the basis of the division of atomic electrons into groups and subgroups governed by quantum numbers a series of mathematical expressions are derived connecting Z and these quantum numbers for the neutral unexcited atom. L.Bovey

539.153.4

9344. A METHOD OF IMPROVING ENERGY-LEVEL CALCULATIONS FOR "SERIES" ELECTRONS. A.S.Douglas.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 4, 687-92 (1956).

A method is described for improving the approximate calculation of energy levels for atomic configurations consisting of a set of closed shells and a single "series" electron. This involves the inclusion of a "polarization" potential in the Hartree–Slater–Fock

equation, caused by the series electron. The form of potential found in two cases investigated, namely, Si^{+3} and Ca^{+}, is described and discussed. A.

539.153.4

9345. THE SELF-CONSISTENT FIELD WITH EXCHANGE FOR SOME 10 AND 12 ELECTRON SYSTEMS. C.Froese.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 1, 206-13 (Jan., 1957).

The results of self-consistent field calculations with exchange for the ground-state configurations of F^{-}, $Fe^{+16,+14}$, $Al^{+3,+1}$ are presented. A.

539.153.4

9346. THE COMPUTATION OF QUADRUPOLE LINE STRENGTHS. R.H.Garstang.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 1, 214-21 (Jan., 1957).

The methods introduced into the theory of atomic spectra by Racah are applied to the problem of the computation of the strengths of electric quadrupole lines. Detailed numerical results are given for two configurations of equivalent d-electrons. A.

539.153.4 : 535.331

THE ELECTRONIC CONFIGURATIONS OF Mn II. See Abstr. 9066

539.153.4 : 535.331

IONIZATION POTENTIALS OF THE PALLADIUM GROUP ELEMENTS. See Abstr. 9067

539.155.2

9347. SOME UPPER LIMITS OF ISOTOPIC ABUNDANCE. III. C, O, and Zn. L.Kerwin, D.E.McElcheran and M.Cottin.
Canad. J. Phys., Vol. 35, No. 6, 783-4 (June, 1957).

For Pt II, see Abstr. 7314 (1957). The present status of the isotopic abundance of the above elements is given, including values for the upper limits for rare isotopes obtained by the authors. H.C.Cole

539.155.2 : 535.331

SPECTRAL ANALYSIS OF AN ENRICHED URANIUM ISOTOPE MIXTURE. See Abstr. 9068

539.156

9348. APPROXIMATIONS FOR THE TREATMENT OF INELASTIC ATOMIC COLLISIONS. D.R.Bates.
Proc. Roy. Soc. A, Vol. 240, 437-46 (July 16, 1957).

Approximations for the cross-sections describing collisions between heavy systems at moderate velocities of relative motion are considered, rotating axes being used. The relations between the various wave treatments are discussed, it being pointed out, in particular, that that between the Born and the perturbed stationary-state approximation is not as has been generally supposed. Consideration is also given to the corresponding impact-parameter treatments. A.

RADIOACTIVITY. α-, β- AND γ-RAYS 539.16

539.16.08

9349. NEW EQUIPMENT FOR THE STUDY OF RADIOACTIVE CLOUD. H.Garrigue.
C.R. Acad. Sci. (Paris), Vol. 244, No. 17, 2249-51 (April 24, 1957). In French.

A brief description of mobile equipment for counting low-activity samples. M.A.Grace

539.163

9350. A SEARCH FOR NATURAL RADIOACTIVITY IN VANADIUM. R.N.Glover and D.E.Watt.
Phil. Mag. (Eighth Ser.), Vol. 2, 697-9 (May, 1957).

The absence of detectable β activity or K X-radiation enabled upper limits of 2.4×10^{14} and 4×10^{13} years to be set on the half-lives for β and K-capture decay in V^{50}. Scintillation counter measurements show evidence for γ-radiation which is attributed to K-capture decay, with a half-life of $(4.0 \pm 1.01) \times 10^{14}$ years, to the first excited state of Ti^{50}. M.A.Grace

539.163.2

9351. THE β-RAY SPECTRUM OF Ta^{182}.
J Demuynck, J.Verhaeghe and B.Van der Velde.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3050-2 (June 17, 1957). In French.

The low energy β-spectrum of Ta^{182} has been measured with a double-focusing spectrometer. Three components are observed with maximum energies 514 ± 5, 443 ± 10 and 363 ± 15 keV. L.L.Green

539.163.2

9352. THE DE-EXCITATION OF C^{12} BY THE EMISSION OF A NUCLEAR PAIR. R.R.Roy, M.L.Goes and A.Pirson.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3054-6 (June 17, 1957). In French.

The pairs emitted in the $0 \rightarrow 0$ transition from the 7.65 MeV state in C^{12}, produced by the $Be^{9}(\alpha,n)C^{12}$ reaction, have been studied. 120 electron pairs have been photographed in a cloud chamber and the electron and positron energy distributions are given. L.L.Green

539.163.2

9353. POLARIZATION OF THE ELECTRONS EMITTED BY Sr^{90}. H Langevin-Joliot, N.Marty and P.Sergent.
C.R. Acad. Sci. (Paris), Vol. 244, No. 26, 3142-4 (June 24, 1957). In French.

The negative polarization of electrons emitted by Sr^{90} ($\Delta J = 2$, yes) is shown by electrostatic deflection of the electrons followed by scattering by a gold foil. L.L.Green

539.163.2

9354. ON THE DECAY OF ^{141}Ce. G.B.Zorzoli.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 289-90 (Jan., 1957).

Observations have been made on the β- and γ-ray spectra from the decay of Ce^{141}. It is concluded that the 145 keV transition from the first excited state of Pr^{141} is an M 1 transition. L.L.Green

539.164

9355. α-SPECTRUM OF BISMUTH 212 (ThC). R.J.Walen and G.Bastin-Scoffier.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 676-7 (Aug. 5, 1957). In French.

Magnetic spectrograph evidence is presented for a new ray, α_6 of intensity 10^{-5} of the total intensity. A regularity in the energy differences between α_2, α_4 and α_6 is attributed to a family of vibration levels. W.O.Lock

539.165

9356. STUDY OF LOW-ENERGY ELECTRONS EMITTED BY RADIOACTIVE SUBSTANCES, USING A DOUBLE-FOCUSING SPECTROMETER. J.B.Bellicard.
Ann. Phys. (Paris), Ser. 13, Vol. 2, No. 5-6, 419-70 (May-June, 1957). In French.

A double-focusing iron-free spectrometer (ρH_{max} = 5 800 gauss cm, corresponding to $E_{max} \sim 1.3$ MeV) was constructed, and, using very thin sources of high specific activity, the low-energy electron spectra emitted by Th active deposit, by Zn^{65} and by Co^{57} were examined. A.O.Stanesby

539.165

9357. A STUDY OF THE EXCITATION AND AUTOIONIZATION OF THE ELECTRON CLOUD ACCOMPANYING THE K-CAPTURE OF Ge^{71}. M.Langevin.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 664-7 (Aug. 5, 1957). In French.

The formation of double vacancies in the K-shell was studied with a source of Ge^{71} introduced as a gas within a propane proportional counter. It is found that the probability for producing a double vacancy is $(1.33 \pm 0.14) \times 10^{-4}$ while that for ejecting an electron is $(0.78 \pm 0.07) \times 10^{-4}$. Both these values agree with the theory of Primakoff and Porter. M.A.Grace

539.165

9358. THE ORBITAL ELECTRON CAPTURE DECAY OF ^{185}Os. A.Bisi, E.Germagnoli and L.Zappa.
Nuovo Cimento, Vol. 6, No. 2, 299-303 (Aug., 1957).

Radiations emitted in the orbital electron capture decay of Os^{185} have been investigated by means of a scintillation spectrometer and with the help of coincidence methods. The total decay energy was found to be 984 keV: the orbital electron capture decay is complex and one of the transitions involved shows an anomalous L/K-capture ratio. It is suggested that this transition can be classified as second forbidden ($\Delta I = 2$; yes). A.

539.16

9359. ELECTRON CAPTURE IN ARSENIC 74 AND ARSENIC 76. J.Scobie.
Nuclear Physics, Vol. 3, No. 3, 465-70 (May, 1957).

The radiations of As^{74} and As^{76} have been studied, using proportional tube spectrometers with gaseous sources of radioactive arsine. Peaks have been observed in the As^{74} pulse spectrum, corresponding to the K and L radiations of germanium emitted in

the electron capture decay to Ge^{74}. From the number of counts in the observed peaks and the total number in the pulse spectrum the ratio of electron capture to electron emission was found to be 0.67 ± 0.04. The ratio of L-capture to K-capture, determined from the relative areas under the electron capture peaks, is 0.085 ± 0.020, in agreement with the theoretical value of 0.095. A search has been made for electron capture in As^{76}, using a proportional counter with an internal anti-coincidence system to reduce wall-effect. No K-capture was observed with an intensity greater than 0.02% of the negatons. A.

539.165

9360. STUDY OF AUGER K ELECTRONS EMITTED BY Zn^{65}. J.B.Bellicard, A.Moussa and S.K.Haynes.
Nuclear Physics, Vol. 3, No. 2, 307-13 (April, 1957). In French.

Using a double-focusing magnetic spectrometer with ironless coils, the energies and relative intensities of the groups of Auger K lines of Cu^{65} resulting from the decay of Zn^{65} have been determined. A.

539.165

9361. A SEARCH FOR ELECTRON CAPTURE IN ^{176}Lu. R.N.Glover and D.E.Watt.
Phil. Mag. (Eighth Ser.), Vol. 2, 699-702 (May, 1957).

No evidence was found for electron capture, and the branching ratio must be less than about 3%. The half-life of Lu^{176} against beta-decay was estimated to be $(2.1 \pm 0.2) \times 10^{10}$ years from the intensity of the γ-rays. J.M.Cassels

539.165 : 539.166

9362. CIRCULAR POLARIZATION OF γ-RAYS: FURTHER PROOF FOR PARITY FAILURE IN β DECAY. H.Schopper.
Phil. Mag. (Eighth Ser.), Vol. 2, 710-13 (May, 1957).

A circular polarization detector was used in a β–γ coincidence experiment to show that the γ-rays emitted in the opposite direction to the β-rays in the decay of Co^{60} and Na^{22} are circularly polarized: this shows that parity is not conserved in the β decay. The degree of circular polarization is assumed to have the form $\alpha(v/c)\cos\theta$. For Co^{60} α is measured as -0.41 ± 0.07 and for Na^{22} $+0.39 \pm 0.08$: this shows that the antineutrino accompanying β^- decay has the opposite screw sense to the neutrino in β^+ decay. M.A.Grace

539.165

9363. A DEMONSTRATION OF PARITY NON-CONSERVATION IN β-DECAY.
M.A.Grace, C.E.Johnson, R.G.Scurlock and C.V.Sowter.
Phil. Mag. (Eighth Ser.), Vol. 2, 1050-3 (Aug., 1957).

It is shown that the blackening of Ilford Industrial G X-ray film may be used at $1^\circ K$ to detect β-rays and this method was used to demonstrate the backward–forward asymmetry in the β-rays from Co^{60} polarized by the very low temperature method. An 18% excess of β-rays emitted against the direction of the nuclear spin was observed for a nuclear polarization of 25%. M.A.Grace

539.165

9364. LONGITUDINAL POLARIZATION OF BETA-PARTICLES FROM ^{60}Co, ^{32}P AND ^{170}Tm. H.de Waard and O.J.Poppema.
Physica, Vol. 23, No. 7, 597-8 (July, 1957).

Electrons of 168 keV were first deflected through 90° by an electrostatic analyzer and then scattered in a gold foil. The observed left–right asymmetry leads to the following values for the polarization: 0.49 ± 0.11 (Co^{60}), 0.50 ± 0.11 (P^{32}), 0.35 ± 0.11 (Tm^{170}) and 0.16 ± 0.03 (Au^{196}). In each case the sign of the effect shows that the electron spin and momentum vectors are antiparallel. M.A.Grace

539.165 : 539.153.4

CAPTURE HALF-LIFE OF Be^7. See Abstr. 9339

539.165.08

9365. ON A METHOD FOR REDUCING SELF-ABSORPTION IN ABSOLUTE β-MEASUREMENTS WITH A 4π-COUNTER.
Y.Le Gallic and M.Thénard.
C.R. Acad. Sci. (Paris), Vol. 244, No. 24, 2909-12 (June 12, 1957). In French.

The use of certain wetting-agents enables the production of more uniform thin radioactive sources. A.O.Stanesby

539.165.2

9366. THE INTERACTION OF THE β-DISINTEGRATION WHICH DOES NOT CONSERVE PARITY. R.Nataf.
C.R. Acad. Sci. (Paris), Vol. 244, No. 26, 3144-7 (June 24, 1957). In French.

It was shown in a previous paper (Abstr. 5595/1957) that, on the hypothesis of invariance with respect to time reversal, one derives formulae implying that the direction of longitudinal polarization of the β-particles is independent of the interaction. Preliminary experiments by Deutsch and Goldhaber (to be published) appear to indicate that the direction of polarization in an allowed transition due to a Gamow–Teller interaction is opposite to that in an allowed transition due to a Fermi interaction. One should then abandon invariance with respect to time reversal. Various possibilities are discussed. L.Pincherle

539.165.2

9367. POLARIZATION OF THE ELECTRONS EMITTED BY S^{35}. H.Langevin-Joliot and N.Marty.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 670-2 (Aug. 5, 1957). In French.

The polarization of the β-rays of energy 128 keV emitted by a source of S^{35} (transition $\Delta J = 0$, no) has been found to be -0.38 ± 0.1. L.L.Green

539.166

9368. THE WEAK LINES IN THE RADIUM D GAMMA SPECTRUM. A.C.L.Barnard and B.C.Haywood.
Phil. Mag. (Eighth Ser.), Vol. 2, 713-16 (May, 1957).

It is shown that weak K fluorescence of the source materials may be excited by the decay electrons and it is suggested that some of the weak lines attributed to nuclear γ-rays may arise from this cause. M.A.Grace

539.166

9369. NOTE ON THE 1.75 MeV GAMMA RAY FROM THE DECAY OF ^{56}Co. M.Morita, H.Ogata and M.Sakai.
Physica, Vol. 22, No. 10, 915-16 (Oct., 1956).

The experimental results on the anisotropy of this radiation were re-examined with the possibility of a mixed dipole and quadrupole transition in mind; the results are consistent with a spin of 4+ for the ground state of Co^{56} and a value for the mixing ratio δ of $+0.05$. A.O.Stanesby

539.166

9370. GAMMA–GAMMA ANGULAR CORRELATION IN THE DECAY OF ^{203}Pb. B.van Nooijen and A.H.Wapstra.
Physica, Vol. 23, No. 5, 404-6 (May, 1957).

The angular correlation between the 404 and 279 MeV γ-rays is shown to depend on the physical state of the source, the maximum being $1 - (0.181 \pm 0.007)\cos^2\theta$. Combined with other data on the 279 MeV transition this result leads to values for the E2/M1 mixing ratio for the 404 keV γ-ray of -0.108 ± 0.011 or $+0.025 \pm 0.006$ depending whether the 683 keV state is of spin 3/2 or 5/2. M.A.Grace

539.166.74

9371. THE ANGULAR DISTRIBUTION OF ELECTRONS IN THE COMPTON EFFECT. R.R.Roy, M.L.Goes and I.Kozlowitz.
C.R. Acad. Sci. (Paris), Vol. 244, No. 22, 2706-7 (May 27, 1957). In French.

The electrons were produced by 835 keV γ-rays striking a 40μ Al foil and the angular distribution (0°-60°) was studied using a cloud chamber. From about 250 electron tracks it is concluded that the results are in accord with the Klein–Nishina theory. M.A.Grace

539.166.74 : 539.172.3

9372. RESONANCE SCATTERING OF γ-RAYS ON NUCLEI. B.S.Dzhelepov.
Uspekhi fiz. Nauk, Vol. 62, No. 1, 3-40 (1957). In Russian.

A review article with 71 references (10% Soviet) which discusses such topics as: the natural energy breadth of the excited states of nuclei, the probability of resonance excitation of nuclei and resonance scattering of γ-rays, resonance excitation of nuclei by a continuous γ-spectrum, effect of heating a source, the angular distribution of resonance-scattered γ-rays, use of Compton effect for observing resonance scattering, inelastic resonance scattering of γ-rays, resonance scattering at high energy. C.R.S.Manders

539.166.75 : 537.531.7

GAMMA-RAY ABSORPTION COEFFICIENTS. See Abstr. 9229

539.166.83

9373. IONIZATION FOLLOWING INTERNAL CONVERSION IN XENON. F.Pleasonton and A.H.Snell.
Proc. Roy. Soc. A, Vol. 241, 141-52 (Aug. 7, 1957).

The predominant internal conversion accompanying the decay of 12 day Xe^{131m} from its metastable nuclear level to its stable ground state usually leaves the atoms in states of high multiple ionization, even though only a single primary electron vacancy is created in the initial process. The differential charge spectrum of

the ions has been measured by the methods of magnetic analysis. Only 0.62 ± 0.08% of the decays leave the atom singly charged. The most probable state of ionization is 8, following 21.06 ± 0.21% of the nuclear transitions, and corresponding to the depopulation of the outer electron shell. Thereafter the probability of occurrence decreases toward the higher charges, twenty electrons being thrown off in 0.003 ± 0.002% of the decays, which presently is about as far as the sensitivity of the spectrometer carries the spectrum. The mechanism of this multiple ionization is discussed in terms of successive Auger events. An analysis of the intensity of the singly charged ions in particular, suggests that they result predominatly from a combination of direct internal conversion in the outer shell of the atom and of K-shell conversion followed by the (1s-5p) X-ray transition. The upper limit thereby set for the 5p shell conversion coefficient is 0.28, and the upper limit for the intensity of the (1s-5p) line is 0.011 in a total K-series intensity of 1. A.

539.167.3 : 539.172.4

9374. ABSORPTION CURVE OF FALLOUT PRODUCTS. A.Aron.
An. Acad. Brasil Ciênc., Vol. 28, No. 4, 423-5 (1956).

The absorption curve of the fallout products was determined in terms of mg/cm^2 of aluminium. The air filter was presented to either an end-window or a Maze-type cylindrical counter and Al absorbers over a range of about 10-1000 mg/cm^2 were used. The penetrating component of the radiation shows an absorption coefficient of 3.5 per g/cm^2, and the measurements, spread over a month, showed no change of absorption curve with time. L.E.Mussell

539.167.3 : 539.172.4

9375. MEASUREMENTS OF LONG-RANGE FALLOUT IN RIO de JANEIRO. G.Kegel.
An. Acad. Brasil. Ciênc., Vol. 28, No. 4, 447-53 (1956).

The airborne fallout was collected on a filter which was then wrapped round a cylindrical beta-counter and its activity assessed. 20 filters were exposed during the period May 9-July 31, 1956. The decay of the radioactivity of a filter with time was plotted and the initial part of the decay curve is ascribed to natural radioactivity. Using the decay of the remaining activity a probable release date was ascertained. The time variation of fission products in the air is shown for the period studied, the maximum concentration being roughly 2×10^{-19} curie/cm^3. L.E.Mussell

539.167.3

9376. RADIOCHEMICAL PROCEDURE FOR INDIVIDUAL RARE EARTHS. L.R.Bunney, E.C.Freiling, L.D.McIsaac and E.M.Scadden.
Nucleonics, Vol. 15, No. 2, 81-3 (Feb., 1957).

A new method of separation of the rare earths (and yttrium) that occur as U^{235} fission products. Full details are given of the isolation and purification of the rare-earth group and the separation of the elements by ion-exchange. Ho^{166} and Dy^{166} have been identified as fission products. R.D.Smith

NUCLEAR REACTIONS 539.17

539.172

9377. THE STRENGTH FUNCTION IN THE STATISTICAL THEORY OF NUCLEAR REACTIONS. C.Bloch.
Nuclear Physics, Vol. 3, No. 2, 137-52 (April, 1957). In French.

It is shown by means of a simple model that the strength function corresponding to a single particle state of a nucleon interacting with a nucleus has a Lorentz shape in agreement with the analysis of the complex potential model in terms of giant resonances. The value of the imaginary part of the complex potential obtained from this calculation is not directly related to the second moment of the strength function which can be derived from a sum rule. It may, in fact, be appreciably smaller than the root square of the second moment. A.

539.172 : 537.591.8

9378. NUCLEAR DISINTEGRATION CASCADES BY HEAVY PRIMARIES. S.Tokunaga, T.Ishii and K.Nishikawa.
Nuovo Cimento (Ser. 10), Vol. 5, No. 2, 517-19 (Feb., 1957).

Two cosmic-ray heavy primary interactions were observed in emulsion exposed at 8 millibar altitude. Five secondary interactions were formed, giving a rather small mean-free-path (~ 5 g/cm^2) for the products of the primary interactions. R.H.W.Johnston

539.172

9379. ON THE DISINTEGRATION OF HEAVY NUCLEI IN NUCLEAR EMULSION BY COSMIC-RAY PARTICLES. K.Lanius
Nuclear Physics, Vol. 3, No. 3, 391-422 (May, 1957). In German.

A detailed investigation of 1020 disintegration stars, with 1 to 5 prongs, of the heavy nuclei in nuclear emulsion is reported and the results compared with the theoretical model of a nucleon cascade followed by evaporation. The observed frequencies of the emitted α-particles and deuterons are many times larger than the theoretical expectation. The angular distributions and angular correlations as well as the energy spectra of these particles are also in disagreement with the theoretical model. The behaviour of the protons is approximately explained by the model. 70% of the stars have recoil tracks with range $< 6\mu$. Their range distribution, angular distribution and angular correlations are only partially accounted for by the theory. A.

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.172.11 : 537.534.74

9380. ELASTIC SCATTERING OF α-PARTICLES. S.W.MacDowell and J.J.Giambiagi.
Nuovo Cimento (Ser. 10), Vol. 4, No. 6, 1594-6 (Dec., 1956).

Calculations of classical trajectories for penetration of a uniformly charged sphere, using Hamilton–Jacobi theory, indicate a maximum possible scattering angle for 48 MeV α-particles incident on Ag which is not found in experiments. An attempt to calculate the differential elastic scattering cross-section also leads to unsatisfactory results. E.J.Burge

539.172.11

9381. ALPHA–ALPHA SCATTERING AT 38.5 MeV. W.E.Burcham, W.M.Gibson, D.J.Prowse and J.Rotblat.
Nuclear Physics, Vol. 3, No. 2, 217-20 (April, 1957).

A measurement of the angular distribution of the scattering of alpha-particles by helium at 38.5 MeV is described. The c.m.s. cross-section is 110 mb/steradian at 90°, falling to a very sharp minimum of about 0.5 mb/steradian at 64°. Approximate calculations of the phase shifts show that δ_0 and δ_2 are large and δ_4 small; these results are in agreement with other evidence for levels of spin 4 at about 11 MeV and of spin 0 and 2 near to 19 MeV. A.

539.172.13

9382. THE POLARIZATION OF 155 MeV PROTONS ELASTICALLY AND INELASTICALLY SCATTERED FROM CARBON. R.Alphonce, A.Johansson and G.Tibell.
Nuclear Physics, Vol. 3, No. 2, 185-92 (April, 1957).

The polarization of 155 MeV protons elastically and inelastically (4.43 MeV level) scattered from carbon has been measured for angles up to 35° (lab. system). The energy spread of the protons was small enough to allow separation of energy levels by absorbers in a range telescope. The asymmetries were determined for two absorber settings, one corresponding to elastically scattered protons, and the other to elastically plus inelastically scattered protons. The elastic polarization rises from zero at 2° to a maximum of 99.5% at 21°, then goes through a minimum of −18% at 32°.5 and reaches 28.4% at 35°. The inelastic polarization appears to increase from 59% to 96% in the angular region 16°.2 to 27.°4 and then to decrease to 2% at 35°. A.

539.172.13

9383. POLARIZATION OF HIGH ENERGY NUCLEONS EXCITING A COLLECTIVE LEVEL. T.A.J.Maris.
Nuclear Physics, Vol. 3, No. 2, 213-16 (April, 1957).

For a spin–orbit coupling of the form $[\Delta V \times P] \cdot \sigma$, which reduces to the usual $(1/r)(dV/dr)1 \cdot \sigma$ term for a spherical nuclear potential, it is shown that the polarization properties of neutrons scattered on nuclei are in the first Born approximation equal for elastic scattering and all collective excitations, and independent of the potential shape. A.

539.172.13

9384. FUSION INDUCED BY MU-MESONS. T.H.R.Skyrme.
Phil. Mag. (Eighth Ser.), Vol. 2, 910-16 (July, 1957).

An experiment has recently been reported from which it has been inferred that the (p,d) reaction is catalyzed by the presence of mu-mesons forming mesic atoms and molecules. A brief analysis is made in this note of the reaction rates necessary to explain the experimental results. The relatively large number of events observed in which the meson takes away the energy released in the reaction can be understood as the result of conversion of an electric monopole transition. A.

539.172.13

9385. THE REACTION $^{32}S(p,\gamma)^{33}Cl$. C.van der Leun and P.M.Endt. Physica, Vol. 22, No. 12, 1234-6 (Dec., 1956).

A resonance for proton energies of 594 ± 5 keV was found using the Utrecht Cockroft–Walton accelerator. From the γ-radiation at this resonance Cl^{33} was shown to have levels at 0.806 ± 0.004 and 2.861 ± 0.011 MeV. The Cl^{33} mass excess is computed to be −11.36 ± 0.13 MeV. Angular distribution of the three observed γ-rays can be explained by assigning $J = 3/2^+$ to the resonance level, which thus appears to be different from the 2.84 ± 0.06 MeV level with $J = (1/2, 3/2)^-$ obtained from the $S^{32}(d,n)Cl^{33}$ reaction. J.H.Fremlin

539.172.13 : 539.152.1

MEASUREMENTS OF PROTON STRENGTH FUNCTIONS. See Abstr. 9319-20.

539.172.13

9386. POLARIZATION OF NUCLEONS FROM THE BREAK-UP OF THE DEUTERON IN THE ELECTROMAGNETIC FIELD OF A NUCLEUS. J.Sawicki.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 3, 283-9 (1957).

Calculations have been made on the magnetic disintegration of a fast deuteron by the electromagnetic field of a nucleus. The relative importance of the magnetic disintegration increases with deuteron energy and it is suggested the relatively weak magnetic effect appears more distinctly by way of interference with the electric effect in the polarization of the outgoing nucleons. Calculations have been made of this polarization. L.L.Green

539.172.13

9387. DEPENDENCE OF (D+D) NEUTRON POLARIZATION ON DEUTERON ENERGY.
I.I.Levintov, A.V.Miller, E.Z.Tarumov and V.N.Shamshev.
Nuclear Physics, Vol. 3, No. 2, 237-9 (April, 1957).

The polarization of (D+D) neutrons by thick and thin targets has been measured for E_d lying between 0.6 and 1.8 MeV. A.

539.172.13

9388. AN INVESTIGATION OF THE REACTION ^{23}Na (d,n) ^{24}Mg. F.A.El Bedewi and M.A.El Wahab.
Nuclear Physics, Vol. 3, No. 3, 385-90 (May, 1957).

The photographic plate technique has been used to investigate the neutrons emitted from the disintegration of sodium by 8 MeV deuterons. The angular distributions of some neutron groups have been compared with curves calculated from the known deuteron stripping theories. A new level in Mg^{24} at 10.46 ± 0.10 MeV is found to have even parity and spin 1 or 2. A.

539.172.3

9389. THE (γ,n) REACTIONS IN THE NEIGHBOURHOOD OF THRESHOLDS, AND FINE STRUCTURE OF CERTAIN MEDIUM [Z] ELEMENTS. R.Basile.
Ann. Phys. (Paris), Ser. 13, Vol. 2, No. 3-4, 267-308 (March-April, 1957). In French.

These were studied for O, P and Cl, using a betatron as the source of radiation. A.O.Stanesby

539.172.3

9390. A SCINTILLATION SPECTROMETER STUDY OF THE PHOTODISINTEGRATION OF O^{16}. N.L.Svantesson.
Nuclear Physics, Vol. 3, No. 2, 273-98 (April, 1957).

The nuclear reactions $O^{16}(\gamma,p\gamma')N^{15}$ and $O^{16}(\gamma,n\gamma')O^{15}$ were used to study the photodisintegration of O^{16}. Various bremsstrahlung spectra with peak energies ranging between 16 and 30 MeV were used to excite the target nuclei. The photons emitted in the two reactions were measured with a NaI(Tl) scintillation spectrometer covering photon energies from 2 to 11 MeV. The results support the belief of the 6.1 and 6.3 MeV states in O^{15} and N^{15}, respectively, being $p_{3/2}^{-1}$ states. Transitions to these two states, 30%, are together with ground state transitions, 70%, the only ones observed between 20.0-22.5 MeV excitation energies. In the region between 22.5 and 25.0 MeV also transitions to 7, 9 and 10-11 MeV states were observed. Ground-state transitions in this interval occurred in about 40%, while the transition probability to excited states was shared roughly equally between the 6.1-6.3 MeV states and all the other states, mainly the 7 MeV states. σ_{int} from 20-25 MeV amounted to about 0.1 MeV · barn. The ratio between σ_{int} for (γ,p) and (γ,n) reactions was about 3 : 2. The nuclear elastic scattering of photons was also measured and was used to determine the integrated cross-section for photon absorption up to 40 MeV which was found to be 0.3 MeV · barn. A.

539.172.3

9391. THE NUCLEAR PHOTOEFFECT IN LIGHT NUCLEI. F.C.Barker.
Phil. Mag. (Eighth Ser.), Vol. 2, 780-4 (June, 1957).

It is shown that the nuclear shell model can correctly predict the harmonic mean energies for the photoabsorption cross-sections of light nuclei. W.O.Lock

539.172.3

9392. APPRECIATION OF A VELOCITY DEPENDENT POTENTIAL TO THE NUCLEAR PHOTOEFFECT. S.Rand.
Phys. Rev., Vol. 107, No. 1, 208-14 (July 1, 1957).

Calculations of the total photonuclear absorption cross-sections have been carried out for a number of nuclei throughout the periodic table. The shell model, with a velocity-dependent potential, has been used. This potential is proportional to the kinetic energy of the nucleons, and gives rise to a changed effective nucleon mass. One of the effects of such an effective mass is to change the frequencies of the giant gamma-ray absorption resonances. Previous independent-particle model calculations had resulted in frequencies consistently lower than the observed values. With an effective nucleon mass inside the nucleus of about 55% of the normal mass, very good agreement with the experimental values is obtained for medium and heavy nuclei. Within the limits of the assumptions made in the calculations, the forms of the observed excitation curves are closely reproduced, and are peaked at roughly the correct energies. Furthermore, the cross-sections integrated over excitation energies, which are nearly model-independent quantities in the changed-mass case, are, except for the very light nuclei, consistent with the experimental values. A.

539.172.3 : 539.166.74

RESONANCE SCATTERING OF γ-RAYS ON NUCLEI. See Abstr. 9372

539.172.4 : 539.185

9393. ANGULAR DISTRIBUTION OF FAST-NEUTRON INELASTIC SCATTERING.
V.Naggiar, G.C.Phillips, M.Roclawski-Conjeaud and D.Szteinsznaider.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 668-70 (Aug. 5, 1957). In French.

A neutron–gamma coincidence technique has been used to measure forward–backward asymmetries. Iron was studied at 1.50, 1.58, and 1.66 MeV. The asymmetry varies rapidly with energy and is ascribed to interference between levels of different parity in the compound nucleus. There is little or no asymmetry in the neutrons from I^{127} at 1.15 MeV, a result which does not support direct interaction theory. J.M.Cassels

539.172.4

9394. A NEW METHOD OF MEASUREMENT OF NEUTRON POLARIZATION AND n–He^4 PHASE ANALYSIS.
I.I.Levintov, A.V.Miller and V.N.Shamshev.
Nuclear Physics, Vol. 3, No. 2, 221-36 (April, 1957).

A helium analyser for measurement of neutron polarization in the 1-18 MeV energy region is described. The efficiency of the analyser in this region approaches 100%. The sensitivity of the instrument is approximately 20 counts per min for a neutron flux of 10^5 neut./cm^2 sec. The instrument operates practically without any background. The azimuthal asymmetry of 2.45 and 3.4 MeV (D + D) neutrons scattered on He^4 has been measured. Analysis of the result confirms the experimental phase-shift values obtained by Seagrave and contradicts the phase-shift values mentioned by Huber and Baldinger. A.

539.172.4

9395. SCATTERING OF FAST NEUTRONS BY NEON IN THE ENERGY REGION 1.9 TO 3.5 MeV. C.P.Sikkema.
Nuclear Physics, Vol. 3, No. 3, 375-84 (May, 1957).

The scattering of monoenergetic neutrons by neon in the neutron energy range 1.9 to 3.5 MeV has been investigated by measuring the neon recoils in a multiple-wire proportional counter with which a γ-ray background can be reduced to a very low value by an anticoincidence technique. Approximate values for the total cross-section are obtained, which show resonance peaks at 1.94, 2.00, 2.11, (2.45), 2.57, 2.73, 2.88, 3.28, and 3.37 MeV neutron energy. By the study of angular distributions the resonances at 1.94 and 2.00 MeV could be ascribed to a $3/2^+$ and a $3/2^-$ level in the Ne^{21} nucleus respectively. The strong resonance at 2.11 MeV seems to be due to both a $3/2^+$ and a $3/2^-$ level. A.

539.172.4

9396. NEUTRON TOTAL CROSS SECTION OF Np^{237} FROM 0.02 TO 2.8 eV. M.S.Smith, R.R.Smith, E.G.Joki and J.E.Evans.
Phys. Rev., Vol. 107, No. 2, 525-7 (July 15, 1957).

Measurements were made on a sample containing 152 mg of Np^{237} in oxide form dissolved in deuterated nitric acid. A value for the absorption cross-section at 0.025 eV of 170 ± 22 barns was obtained. Resonances were observed at energies 0.489 ± 0.002, 1.337 ± 0.015, and 1.488 ± 0.018 eV, with the respective values of $\sigma_0\Gamma$ being 84.2 eV barns, approximately 29 eV barns, and approximately 140 eV barns. Values for σ_0 of 2600 ± 100 barns, Γ of 0.032 ± 0.003 eV, and $g\Gamma_n$ of 0.016×10^{-3} eV were determined for the 0.489 eV resonance. A.

539.172.4 : 535.33.03

THERMAL NEUTRON CAPTURE BY Au^{198}. See Abstr.9060

539.172.4

9397. THE Sr^{90} YIELD FROM U^{233} FISSION.
M.P.Anikina and B.V.Ershler.
Atomnaya Energiya, Vol. 2, No. 3, 275-6 (1957). In Russian.

The average yield determined by measurements on both the Sr^{90} and the Y^{90} daughter was found to be 4.56 ± 0.08%. L.Bovey

539.172.4 : 539.155.2

9398. THE RARE-EARTH ISOTOPE YIELDS FROM Pu^{239} FISSION BY PILE NEUTRONS. L.M.Krizhanskiĭ, Ya.Malyĭ, A.N.Murin and B.K.Preobrazhenskiĭ.
Atomnaya Energiya, Vol. 2, No. 3, 276-7 (1957). In Russian.

The ratio of isotope yields for $Ce^{140, 142, 144}$, $Nd^{143, 144, 145, 146, 148, 150}$, $Sm^{147, 149, 151, 152, 154}$, $Cs^{133, 135, 137}$ have been determined by both mass-spectrometric and radiochemical methods. Agreement with previous work is good (Abstr. 729/1957) except for Ce^{140} and Cs^{133}. The difference is explained by alteration in experimental conditions. L.Bovey

539.172.4

9399. CHAIN REACTIONS BY FAST NEUTRONS IN ENRICHED URANIUM. M.Feix, P.Nicourd and S.Valentin.
C.R. Acad. Sci. (Paris), Vol. 244, No. 20, 2502-5 (May 13, 1957). In French.

The reactivities of infinite uranium media are calculated from the known fast-neutron cross-sections. J.M.Cassels

539.172.4

9400. THEORY OF THE OSCILLATING ABSORBER IN A DIFFUSING MEDIUM. B.Cimbleris.
An. Acad. Brasil. Ciênc., Vol. 28, No. 4, 429-38 (1956). In Portuguese.

A theoretical study of the effect of time variation in neutron absorption in a reactor under the assumptions of an infinite diffusing medium, of a point source and a harmonic modulation. The effect of this "oscillating absorber" is equivalent to having a source of neutrons varying sinusoidally in time. The diffusion equation is solved by standard methods and, as observed by other authors, complete analogy is found with heat propagation from a pulsating source. L.Pincherle

539.172.4

9401. ONE-GROUP PERTURBATION THEORY FOR SPHERICALLY SYMMETRIC REACTORS. J.Codd.
Atomic Energy Res. Establ. (Harwell), Mem. RP/M42, 8 pp. (1957).

Expressions are given for some integrals which are required in the application of perturbation theory to a reactor comprising a spherical core surrounded by a reflector. The analysis is based upon one-group diffusion theory, in both the elementary and the modified forms. A.

539.172.4

9402. AN ARRANGEMENT FOR LOW-TEMPERATURE IRRADIATION IN AN ATOMIC PILE. P.Lucasson.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 678-80 (Aug. 5, 1957). In French.

The equipment is designed for irradiation of small samples in a fast neutron flux in the E.L.2 reactor at Saclay. The cooling is by liquid nitrogen. J.Adam

ATOM AND MOLECULE BEAMS. MESONS. NEUTRONS 539.18

539.18

9403. K-MESONS. S.R.de Groot and H.A.Tolhoek.
Ned. Tijdschr. Natuurkde., Vol. 23, No. 5, 121-30 (May, 1957). In Dutch.

A general paper, giving the latest experimental results, the position of the K-mesons in the array of elemental particles, and their possible part in the formation of heavy particles. The problem of the charged K-mesons is mentioned, and the neutral K-mesons are described, which can be regarded as a mixture of particles with two different lifetimes. C.Turner

539.18 : 530.145

POSSIBLE EXISTENCE OF A HEAVY NEUTRAL MESON. See Abstr. 9010

539.18

9404. STRANGE PARTICLES (ISOTOPE MULTIPLET SCHEME). L.Okun'.
Uspekhi fiz. Nauk, Vol. 61, No. 4, 535-59 (1957). In Russian.

The term was applied by Gell-Mann to heavy mesons and hyperons (Abstr. 1039/1954) and the present paper is concerned with an examination of problems associated with their isotope spin. Among topics surveyed are:- decay schemes of K-mesons and hyperons; strong interactions with $\Delta S = 0$ or $\Delta T = 0$; the origin, scattering and absorption of particles; hyper-nuclei and K-nuclei; electromagnetic interaction; particle decay with $\Delta S = \pm 1$ or $\Delta T = \pm\frac{1}{2}$; other possible particles in the scheme of isotope multiplet. There are two useful mathematical appendices and a list of 82 references (one third Soviet). C.R.S.Manders

539.18

9405. CASCADE DECAY OF A HEAVY K-MESON.
S.N.Sen Gupta and M.S.Sinha.
Phil. Mag. (Eighth Ser.), Vol. 2, 936-8 (July, 1957).

Two associated V-events in a multiplate cloud chamber are interpreted as a cascade decay of a charged particle (mass ≥ 1460 m into an L-meson and a θ^0-meson. R.H.W.Johnston

539.18 : 539.172

9406. π-MESONS (REVIEW OF EXPERIMENTAL DATA).
L.M.Barkov and B.A.Nikol'skiĭ.
Uspekhi fiz. Nauk, Vol. 61, No. 3, 341-98 (1957). In Russian.

The paper aims to systematize the basic experimental information concerning the properties of π-mesons and their interactions with nucleons and nuclei. Lack of an overall theory of nuclear interaction only permits communication of experimental results without theoretical interpretation. Many of the conclusions in this survey article are therefore only qualitative. Pt I deals with π-mesons and their interactions with free nucleons, Pt II with π-mesons and nuclei. Processes of multiple production of π-mesons are not considered. 226 references. C.R.S.Manders

539.18

9407. THE LIFETIME OF $^3H_\Lambda$ HYPERFRAGMENTS.
M.W.Friedlander.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 283-4 (Jan., 1957).

A value of order 3.7×10^{-10} second is indicated for the H^3_Λ lifetime from the observations on two decays in flight and twelve decays at rest. Possible sources of bias are discussed. J.W.G.Wignall

539.18

9408. SOME REMARKS ON DECAY RATES OF HEAVY MESONS.
B.D'Espagnat, R.Omnes and J.Prentki.
Nuclear Physics, Vol. 3, No. 3, 471-5 (May, 1957).

The lifetimes of particles and their antiparticles are discussed under different assumptions. It is shown that if parity and charge conjugation (P.C) is conserved these lifetimes are rigorously equal but in practice their equality is no evidence for P.C conservation even when strong final state interactions do exist. The P.C conservation is best tested by the K^0 modes of decay. A description of $K\mu\nu$ interaction by means of a direct coupling only (Yukawa type) is shown to be impossible. A

539.18

9409. THE ANGULAR DISTRIBUTION OF MUONS FROM $\pi-\mu$ DECAY. F.Bruin and M.Bruin.
Physica, Vol. 23, No. 6, 551-2 (June, 1957).

Analysis of decay angles of 400 $\pi-\mu$ decays, found by area-

scanning in Bevatron-exposed emulsion, suggests a backward–forward asymmetry. The probability of isotropy is 10% if the parts of the angle distribution stated to be subject to scanning bias are omitted, 4% if included. R.H.W.Johnston

539.18

9410. THE ANGULAR DISTRIBUTION OF CHARGED K^+-MESON SECONDARIES. F.Bruin and M.Bruin.
Physica, Vol. 23, No. 6, 553-4 (June, 1957).

Analysis of the decay angles of 500 K^+meson secondaries, found by area-scanning in Bevatron-exposed emulsion, gives no indication of any anisotropy. R.H.W.Johnston

539.18

9411. THE MASS DIFFERENCE BETWEEN THE Σ^+ AND Σ^- HYPERONS. R.C.Kumar, W.B.Lasich and F.R.Stannard.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 746-7 (March,1957).

Describes a K^- capture by a free proton in photographic emulsion according to the reaction: $K^- + P \rightarrow \Sigma^- + \pi^+$ the Σ^- having a range of $714 \pm 18\,\mu$. Combining this result with earlier measurements on collinear Σ^- and Σ^+ events gives $M_{\Sigma^-} = 2339.6 \pm 1.6\ m_e$ and $M_{\Sigma^-} - M_{\Sigma^+} = (14.1 \pm 2.3)m_e$.
K.H.Barker

539.18 : 530.145

BARYON MASSES. See Abstr. 8999

539.18

9412. ON THE SPIN OF THE $K_{\mu 3}$ MESON.
L.A.Radicati and S.Rosati.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 729-31 (March, 1957).

A calculation of the momentum spectrum of the μ-meson from the decay $K_{\mu 3} \rightarrow \pi + \mu + \nu$ assuming a single coupling, and a graphical presentation of the results for spin 0, 1 and 2.
K.H.Barker

539.18 : 778.34

9413. APPLICATION OF THE KLAUSEN MICROMETER TO THE MEASUREMENTS OF MULTIPLE SCATTERING OF ELEMENTARY PARTICLES IN NUCLEAR EMULSIONS. G.Alvial and S.Stantic.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1333-4 (May, 1957).

Comparison with a Koristka filar micrometer indicated that the Klausen micrometer has the same precision and is 1.7 times as rapid. The cell scheme of Fay, Gottstein and Hain (Abstr. 10767/1954) was used for 15 π-mesons and the mean of the second differences $\bar{D}_{sc}$ was found to be $0.429 \pm 0.015\mu$m. E.J.Burge

539.18 : 530.145

LOW ENERGY K-NUCLEON SCATTERING. See Abstr. 8991

539.18

9414. THE ABSORPTION OF SLOW NEGATIVE π-MESONS BY THE ELEMENTS IN NUCLEAR EMULSIONS.
G.Brown and I.S.Hughes.
Phil. Mag. (Eighth Ser.), Vol. 2, 777-9 (June, 1957).

Observations on π-meson stars, in diluted and normal G5 emulsions, confirm the prong number distribution from light and heavy nuclei determined by less direct methods. W.O.Lock

539.18

9415. ON THE Σ HYPERON–NUCLEON INTERACTION CROSS-SECTION. N.Dallaporta and F.Ferrari.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 742-5 (March, 1957).

A calculation of the total cross-section in nuclear matter (for scattering and Λ-production) of Σ-hyperons, produced by K^- capture, for various values of Λ_p/Σ_p (nucleon capture) and Λ_n/Σ_n (nucleus capture). Experimental values of these two parameters correspond to a cross-section between 45 and 50 mb. K.H.Barker

539.18

9416. SMALL-ANGLE PHOTOPRODUCTION OF POSITIVE MESONS FROM HYDROGEN. E.Knapp, W.Imhof, R.W.Kenney and V.Perez-Mendez.
Phys. Rev., Vol. 107, No. 1, 323-4 (July 1, 1957).

Gives details of measurements of the relative angular distributions in the c.m. range 0-53° for the yield of π^+ mesons produced in liquid hydrogen by (260 ± 5) MeV γ-rays. The results are normalized to the C.I.T. magnet data and compared with the Chew–Low theory. K.H.Barker

539.18

9417. ENERGY DISTRIBUTION OF DECAY PIONS OF SOME τ^+-MESONS. D.J.Holthuizen, T.G.Lim and S.J.Bosgra.
Physica, Vol. 23, No. 2, 179-80 (Feb., 1957).

Measurements on 18 τ^+-mesons found in plates exposed to the K^+ beam of the Bevatron. A table is given of the π-meson energies obtained from both angle and range measurements. K.H.Barker

539.185

9418. COLD NEUTRON SCATTERING IN ALUMINIUM.
L.S.Kothari and K.S.Singwi.
Phil. Mag. (Eighth Ser.), Vol. 2, 694-6 (May, 1957).

Earlier calculations (Abstr. 9280/1955) are extended to allow for the variation of the Debye temperature with increasing temperature, and also include a re-evaluation of the correction to the incoherent approximation. For Al at 800°K, the theoretical scattering cross-section for 8 A neutrons is 0.79 barn, and agrees well with the experimental value of 0.81 barn. E.J.Burge

539.185 : 539.152.1

9419. AN ESTIMATE OF THE IMAGINARY PART OF THE COMPLEX POTENTIAL OF NEUTRON SCATTERING.
A.van der Vegt and C.C.Jonker.
Physica, Vol. 23, No. 4, 359-60 (April, 1957).

The maximum in W for $E_n \cong 75$ MeV, found by Lane and Wandel (Abstr. 8987/1955) was absent when the values of Fowler and Brolley (Abstr. 7737/1956) for σ_{np} were used, together with the values for $E_n = 345$-595 MeV given by Dzhelepov et al. (Dokl. Akad. Nauk SSSR, Vol. 104, 717, 1955). E.J.Burge

539.185.9 : 537.311.31

THE EFFECT OF FAST-NETRON IRRADIATION ON METALS WITH CUBIC STRUCTURES. See Abstr. 9164

STRUCTURE OF SOLIDS 539.2

539.213 : 548.736.3

9420. STRUCTURE OF TELLURIUM OXIDE GLASS. G.W.Brady.
J. chem. Phys., Vol. 27, No. 1, 300-3 (July, 1957).

An X-ray analysis was made. This glass is unusual in that it is made up of octahedra which exhibit a close order configuration such that four oxygens are found at a distance of 1.95 A and two others at 2.75 A. This configuration is similar to that found in the crystal. The way in which the octahedra link together is discussed and some observations on the "edge-opening" process are discussed. Possible presence of crystallites in the glass is indicated. A.

539.217

9421. DETERMINATION OF THE DIFFUSION COEFFICIENTS OF SILVER AND IODINE IN THE THREE MODIFICATIONS OF SILVER IODIDE BY THE METHOD OF HETEROGENEOUS ISOTOPIC EXCHANGE. P.Jordan and M.Pochon.
Helv. phys. Acta, Vol. 30, No. 1, 33-48 (1957). In French.

The rate of exchange of radioactive Ag^+ and I^- ions between specimens of the three allotropes of AgI and aqueous solution ($AgNO_3$ and KI) has been studied between 20 and 200° C (sic). The solid specimens were in the form of powders with particles of known diameter or compressed pellets. The following diffusion coefficients were determined (units cm^2/sec and activation energies in kcal/mole): (1) for the high-temperature cubic form, D(I in α-AgI) = $4.8 \times 10^{-5} \exp(-14.5/RT)$, (2) for the low-temperature wurtzite form, D(Ag in β-AgI) = $5 \times 10^{-4} \exp(-8.5/RT)$,(3) for the low-temperature zinc-blende form D(Ag in γ-AgI) = $0.32 \exp(-14.2/RT)$. For the other cases the rate of exchange was limited by factors other than diffusion in the solid and D could not be determined. The results for D(Ag in β-AgI) agree with measurements of self-diffusion and ionic conductivity. A.B.Lidiard

539.217

9422. DIFFUSION OF ZINC IN ZINC OXIDE.
J.P.Roberts and C.Wheeler.
Phil. Mag. (Eighth Ser.), Vol. 2, 708-10 (May, 1957).

The diffusion of radioactive Zn^{65} in sintered ZnO specimens was studied in O_2 and A atmospheres between 800 and 1300° C. Diffusion profiles characteristic of grain boundary diffusion were observed. Comparison with theory (Abstr. 1287/1955) allows $D^{1/2}/D'\delta$ to be evaluated (D = volume diffusion coefficient, D' = grain boundary diffusion coefficient, δ = grain boundary thickness), and for 1 atm O_2 it was found that $D^{1/2}/D'\delta = 10^{4 \pm 2} \exp(24 \pm 12$ kcal mole^{-1}/RT) sec$^{1/2}$ cm^{-2}. This parameter was found to be considerably smaller in 1 atm A. Chemical methods showed that for the A atmosphere the excess non-stoichiometric Zn was larger than in O_2, suggesting that D decreases with increasing Zn excess. A.B.Lidiard

539.219 : 539.374 : 548.7

9423. THE DETERMINATION OF THE STRENGTH OF THE INTERATOMIC BOND AND THE LATTICE DISTORTION IN THE CASE OF SOME Al- OR Ti-CONTAINING COMPOUNDS OF HIGH MELTING POINT AND THEIR SOLID SOLUTIONS.
J.S.Umanskij and S.M.Nikolaeva.
Acta tech. Hungar., Vol. 18, No. 1-2, 3-11 (1957).

The authors attempted the determination of the characteristic temperature of the very stable metallic compounds CoAl, NiAl and TiC, having a high melting point, as well as that of their solid solutions, and the comparison between the static and dynamic lattice distortion of substitutional and defective solid solutions. The characteristic temperatures of the above alloys were determined by the method of measuring the relative intensities of X-ray interferences at 110, 295 and 473°K. The lattice distortion was determined by X-ray micrographs. The microhardness of the alloys was determined too. The authors came to the following conclusions: (a) when comparing the trend in the variation of the static lattice distortion and the values of microhardness it is found that the chemical distortions do not alter considerably the resistance of the investigated alloys to plastic deformation, because this effect is to a great extent masked by the influence of the interatomic bonding force; (b) when comparing the microhardness values of the alloys with the static distortion values it is found that the lattice distortion of the defective solid solutions exerts a much greater effect on the microhardness of the alloy, than the distortions resulting from the simple substitution of atoms in a substitutional solid solution. A.

539.219 : 536.71

9424. VOLUME CHANGE, HEAT AND ENTROPY OF MIXING IN LIQUID INDIUM–MERCURY ALLOYS. O.J.Kleppa and M.Kaplan.
J. phys. Chem., Vol. 61, No. 8, 1120-3 (Aug., 1957).

A method is described which permits direct determination of the integral volume change associated with the formation of low-melting liquid alloys. The method has been applied to indium–mercury alloys. For indium contents below 50 atomic % the following expression gives the molar volume change when the liquid alloy is formed from mercury and solid indium: $\Delta V^M(60^\circ) = -0.95x_{In} + 1.66x^2_{In}$ cm³/gram-atom. The heat of mixing of indium and mercury was determined at 80° and at 150°(160°). The dependence on temperature is slight in this range. The following analytical expression reproduces the experimental values of the integral heat of formation from liquid mercury and solid indium: $\Delta H^M(80^\circ) = -5.5x_{In} + 8.8x^2_{In}$ kJ/gram-atom. These heats are compared with the corresponding free energies derived from e.m.f. data obtained by Sunden at 20° (Z. Elektrochem., Vol. 57, 100, 1953). In spite of the substantial volume contraction the liquid alloy system has a nearly ideal entropy of mixing. A.

539.219 : 548.736.3

9425. THE AXIAL RATIO OF ZINC, AND OF THE ETA AND EPSILON BRASSES. F.R.N.Nabarro.
Phil. Mag. (Eighth Ser.), Vol. 2, 716-18 (May, 1957).

Previous calculations for Zn (Abstr. 3764/1952) are extended to the hexagonal phases of Zn–Cu. The model predicts a transition from a prolate structure to a close-packed one as the Cu concentration increases, thus illustrating the $\eta \rightarrow \epsilon$ transformation.

D.M.Edwards

539.219

9426. DIFFUSION AND SOLUBILITY OF IRON IN GERMANIUM.
A.A.Bugaĭ, V.E.Kosenko and E.G.Miselyuk.
Zh. tekh. Fiz., Vol. 27, No. 1, 207-9 (1957). In Russian.

The test specimens were cut out of monocrystal ingots of Ge in the form of plane-parallel disks 20 mm dia. and 3-6 mm thick. They were electroplated on both plane surfaces with Fe labelled with Fe^{59}. After heating in a high vacuum for a long time, the Fe excess was ground off, and the concentration of Fe in Ge was determined by radioactive counting. It was found that, within the range 750-940° C, the limiting solubility of Fe in Ge varies within $5 \times 10^{14} - 1.5 \times 10^{15}$ cm^{-3}, a diffuse maximum occurring at about 850° C. The coefficients of diffusion of Fe in Ge, as determined by the method of Seitz and Laird, varied from 1×10^{-6} cm²/sec at 775° C to 4.3×10^{-6} cm²/sec at 930° C. The energy of activation, calculated from these coefficient values, amounts to E = 25 000 cal/mole = 1.1 eV. F.Lachman

539.219 : 537.311.33

SOLID SOLUBILITIES OF TIN IN GERMANIUM SINGLE CRYSTALS. See Abstr. 9184

539.219 : 537.311.33

INTERMETALLIC ALLOYS OF PLATINUM AND GOLD WITH THE ALKALINE AND ALKALINE EARTH METALS. See Abstr. 9191

539.232 : 539.27

9427. ELECTRON MICROGRAPHS FROM THICK OXIDE LAYERS ON ALUMINIUM. C.J.L.Booker, J.L.Wood and A.Walsh.
Brit. J. appl. Phys., Vol. 8, No. 9, 347-52 (Sept., 1957).

Electron micrographs have been obtained of the pore structure in the thick oxide layer formed by anodizing aluminium in sulphuric acid. The pores are shown to be minute tubes of approximately 200 A diameter running perpendicularly through the oxide and ending almost in contact with the underlying metal. The pore base thickness has been estimated, and the effect of a change in anodizing conditions on the pore base pattern is shown. A.

539.232 : 537.529

THE INFLUENCE OF THE ELECTRIC FIELD ON THE PROPERTIES OF THIN DIELECTRIC AND SEMICONDUCTING LAYERS. See Abstr. 9224

539.234

9428. THE EFFECT OF INCIDENT ATOMIC VELOCITY ON THE STRUCTURE OF EVAPORATED SILVER FILMS. L.Holland.
Canad. J. Phys., Vol. 35, No. 5, 697 (May, 1957).

Aziz and Scott (Abstr. 7748/1956) found that aggregation in evaporated silver films was low if the incident atomic velocity was low. The author disagrees with this explanation, since the transport energy is only one eighth of the total potential energy of the atoms. The film growth was more probably affected by traces of water vapour, or a low substrate temperature. C.Hilsum

539.234

9429. THE EFFECT OF INCIDENT ATOMIC VELOCITY ON THE STRUCTURE OF EVAPORATED SILVER FILMS.
R.A.Aziz and G.D.Scott.
Canad. J. Phys., Vol. 35, No. 8, 985 (Aug., 1957).

The growth of evaporated silver films depends on the initial mobility of the atoms on the substrate, and is governed by a latent heat of adsorption an order smaller than the normal latent heat of evaporation. Holland's criticisms (preceding abstract) are therefore invalid. C.Hilsum

539.234

9430. PERFECTION OF CONTOUR BY VACUUM DEPOSITED THIN FILMS. S.Tolansky.
Vacuum, Vol. 4, No. 4, 456-63 (Oct., 1954; publ. June, 1957).

The fidelity of contouring of surface micro-steps by evaporated thin deposits of silver, cryolite and zinc sulphide is studied by precision multiple-beam interferometry. As a known step a spiral on silicon carbide is used and successive layers of thin film are deposited on this, the step being re-measured for each increment of deposit. With silver the contour is exact to within plus or minus 3 A up to an overlying silver thickness of some 27 000 A, although the step height being examined is only 480 A in height. Up to thicknesses of 6000 A the measured step is correct very close to the step edge but beyond this thickness a defect sets in, such that there is a build-up on the step riser which reaches a maximum of about 100 A close to the edge. With cryolite and zinc sulphide these defects are notably more marked. The experiments establish that the type of silver coating used in interferometry can be considered to contour surfaces perfectly. Multilayers may tend to obliterate microstructure if this is on a very small scale in extension. A.

539.27

9431. SMALL ANGLE SCATTERING FROM DEFORMED METALS. H.H.Atkinson and R.D.Lowde.
Phil. Mag. (Eighth Ser.), Vol. 2, 589-90 (May, 1957).

The small-angle scattering of "cold" neutrons from samples of recrystallized polycrystalline pure Cu, undeformed and after 10% extension, was studied to decide whether the increased small-angle X-ray scattering of cold-worked material arises from the defects due to cold work or from double Bragg reflection (or surface effects). Neutrons of the wavelength used (8.7 A) are not capable of Bragg reflection and surface effects were minimized by the use of large samples. The fact that no increase of small-angle scattering was noted after cold work suggests that the X-ray effects were in fact due to processes other than true small-angle scattering from defects in the volume of the metal. J.Thewlis

ELASTICITY. STRENGTH. RHEOLOGY 539.3/.8

539.319 : 666.1

9432. INTERNAL STRESSES IN HARDENED GLASSES. I.I.Kitaĭgorodskiĭ and V.L.Indenbom.
Dokl. Akad. Nauk SSSR, Vol. 114, No. 2, 297-300 (1957). In Russian.

Refers to previous papers dealing with the relationship between the strength of hardened sheet glass and the distribution of internal stresses (Dokl. Akad. Nauk SSSR, Vol. 108, 843, 1956; Indenbom, Zh. tekh. Fiz., Vol. 24, 925, 1954) and to a paper by Kitaĭgorodskiĭ and Dynnik (Dokl. Akad. Nauk SSSR, Vol. 50, 181, 1954), in which the principles of the so called isothermic glass hardening were presented and the phenomena occurring during the hardening of glass objects of complicated form were studied qualitatively. The present paper deals with the application of optical polarization methods to cases in which more than one main stress has a value different from zero in the plane of the wave-front (cf. Indenbom, Optical polarization investigations of internal stresses in glass articles, Dissertation, Moscow, Institute of Chemical Technology, 1955). Formulae developed for cylinders and spheres agree well with experimental data. The energy of the internal tension stresses, attaining up to 30-32 kg/mm^2 in glass cylinders and spheres was found insufficient to cause breakdown; this energy suffices to form 0.6 m^2 of new surface per 1 cm^3 of glass, which corresponds to particle size of the order of 10μ. The value of stresses on the glass surface can be determined from the mean birefringence observed along the beam with the maximum path difference. The possibilities of applying the optical polarization method for investigating the distribution of stresses in hardened glass vessels and shells are discussed. F.Lachman

539.371 : 539.374

9433. RELAXATION OF ORIENTED MICROSCOPIC STRESSES. I. B.M.Rovinskiĭ and V.G.Lyuttsau.
Zh. tekh. Fiz., Vol. 27, No. 2, 345-50 (1957). In Russian.

Samples of aluminium and of copper were subjected to strain; after removing the strain the samples were investigated by X-ray photographs showing the lattice period as a function of time. In the results shown the greatest relative increments in the lattice period are 0.025-0.05%. In the course of 500 hours they are reduced to approximately half the initial value; the rate of decrease diminishes gradually and the final value appears to be permanent. Results are discussed in their relation to the authors' previous investigations on elastic and plastic distortion of metals. R.Eisenschitz

539.4

9434. SUMMARIZED PROCEEDINGS OF A CONFERENCE ON STRESS ANALYSIS — CRANFIELD, SEPTEMBER 1956. H.Fessler.
Brit. J. appl. Phys., Vol. 8, No. 8, 307-14 (Aug., 1957).

Papers were read which could be divided into four main subjects: kinetic heating, extensometry and instrumentation, jet efflux and crack propagation, and the proceedings are summarized in this report. A review of recent improvements in methods of experimental stress analysis in the U.S.A. and Canada was also given. A.

539.4.016 : 548.7 : 537.311.31

INFLUENCE OF LATTICE DEFECTS ON THE ELECTRICAL PROPERTIES OF COLD-WORKED METALS. See Abstr. 9165-6

539.576 : 537.311.33

9435. THE DEPTH OF SURFACE DAMAGE PRODUCED BY LAPPING GERMANIUM MONOCRYSTALS. D.Baker and H.Yemm.
Brit. J. appl. Phys., Vol. 8, No. 7, 302-3 (July, 1957).

This was estimated from the increase in minority-carrier diffusion distance as the damaged surface layer was etched away. The depth of damage was found to increase with the particle size of abrasive used for lapping, extending to about 60 μ with 25 μ abrasive. The damage is thought to consist partly of surface fractures and partly of a high density of dislocations. K.W.Plessner

539.62

9436. ATOMIC CAPTURE OF MATERIALS ON FRICTION. D.N.Garkunov and I.V.Kragel'skiĭ.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 2, 326-7 (1957). In Russian.

Selective diffusion was found to occur during the friction between steel against bronze. The surface of steel became covered with a relatively thick layer of a material consisting mainly of Cu which was separated from the solid solution of the bronze. The selective capture was also borne out by using radioactive Zn whose concentration in the captured layer was 1/15-1/10 of that in the original bronze. The bronzes used were BrAZhMts 10-3-1.5 (probably a bronze with 10% Al, 3% Fe and 1.5% Mn) and BrOSN 4-3-1.5 (probably a bronze with 4% Sn, 3% Pb and 1.5% Ni). The layer enriched in Cu was formed on steel only when working with the former bronze, but on both steel and bronze when working with the latter bronze, alcohol–glycerol being used in either case as a lubricant. When MS oil was substituted for alcohol–glycerol, no atomic capture could be observed. F.Lachman

539.62 : 536.22/.23

9437. ON THE CONNECTION BETWEEN SURFACE FRICTION AND HEAT EXCHANGE. É.A.Sidorov.
Zh. tekh. Fiz., Vol. 27, No. 3, 560-6 (1957). In Russian.

The connection between surface friction coefficient and the magnitude of heat flux in different flow regimes of liquids and gases is investigated analytically. A simple universal relation, confirming the available experimental data, is derived. R.F.S.Hearmon

539.893 : 578.088.2

9438. THE DESIGN OF AN APPARATUS FOR BIOLOGICAL EXPERIMENTS AT HIGH HYDROSTATIC PRESSURE. A.C.Downing and D.R.Wilkie.
J. sci. Instrum., Vol. 34, No. 9, 353-5 (Sept., 1957).

A very simple and cheap design is described that can be used up to 1000 atm. The stainless steel pressure chamber is provided with six insulated Pyrotenax leads and a permeability bridge for measuring mechanical changes. It has been used for recording the tension developed by a stimulated muscle but could be readily adapted to suit other experimental requirements. A.

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM. CHEMICAL REACTIONS 541.11/.12

541.124

9439. HETEROGENEOUS REACTIONS INVOLVING OXIDATION AND REDUCTION AT HIGH PRESSURES AND TEMPERATURES. H.P.Eugster.
J. chem. Phys., Vol. 26, No. 6, 1760-1 (June, 1957).

The (simple) technique is described of employing an osmotic system with Pt acting as a semipermeable membrane and gold as an outer protection for the study of these reactions. An isobaric (total pressure 2000 bar) section of the stability field of ferrous biotite is given. This silicate breaks down to four different assemblages depending on the P_{O_2}–T region. The latter in the present investigation extends from P_{O_2} equal to 10^{-14} to 10^{-24} atm and T 500 to 900° C. W.Good

541.128

9440. MECHANISM OF DEUTEROPARAFFIN FORMATION FROM PARAFFIN AND DEUTERIUM ON METALS. I. REACTION BETWEEN METHANE AND DEUTERIUM. K.Miyahara.
J. chem. Phys., Vol. 26, No. 6, 1774-5 (June, 1957).

The observed distribution of deuteromethanes is accounted for by assuming a single reaction scheme rather than the dual type of mechanism proposed by Kemball (Abstr. 5159/1953). W.Good

541.128

9441. MECHANISM OF DEUTEROPARAFFIN FORMATION FROM PARAFFIN AND DEUTERIUM ON METALS. II. REACTION BETWEEN ETHANE AND DEUTERIUM. K.Miyahara.
J. chem. Phys., Vol. 26, No. 6, 1775-6 (June, 1957).

See preceding abstract. The distribution of deuteroethanes observed by Anderson and Kemball is interpretated on the basis of a single reaction scheme. W.Good

PHOTOCHEMISTRY. RADIATION CHEMISTRY 541.14/.15

541.14

9442. PHOTOCHEMICAL PHENOMENA IN SENSITIZED AgCl CRYSTALS IN THE TEMPERATURE RANGE - 185°C TO +20°C. A.Scholz.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 175-202 (1956). In German.

The AgCl crystals were sensitized by Ag_2S and by Ag_2Se additions (0.01 mol%). At −185°C they are photochemically sensitive. The long-wave absorption band (750 mμ for Ag_2S and 680 mμ for Ag_2Se) is considerably more intense than the short-wave photochemical absorption. The photochemical products (centres) must be of a molecular rather than colloidal kind for their stability is distinctly lower than that of the silver colloids. The saturation values of the photochemical absorption increase with increasing temperature accompanied by a gradual transition of the band at 750 mμ to infrared absorption. Several reaction models for the photochemical processes at low temperature are discussed leading to the formulation of reaction-kinetic equations. W.Good

541.14

9443. PHOTOCHEMISTRY IN SENSITIZED SILVER HALIDE CRYSTALS. C.Volke.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 203-28 (1956). In German.

Crystals of AgBr with additions of Ag_2S, Ag_2Se, or Ag_2Te are photosensitive. At room temperature colloidal silver is produced. At low temperatures absorption bands are obtained the position of which in the spectrum is dependent on the nature of the addition. The quantum yield for the production of these bands depends not on the wavelength of the light but on the temperature and on the history of the crystals. A model for the process is set up and the results discussed. W.Good

541.15

9444. STIMULATION OF BRANCHED-CHAIN REACTIONS BY THE ACTION OF PENETRATING RADIATIONS IN THE INITIAL PERIOD OF THE PROCESS. N.M.Emanuel'.
Dokl. Akad. Nauk SSSR, Vol. 111, No. 6, 1286-9 (1956). In Russian.

Concerns the effect of penetrating Co^{60} γ-radiations, applied only during the initial period of the process, on the stimulation of branched-chain oxidation reactions of organic substances (paraffin) at high temperature (127°C). The theory of degenerate branched-chain reactions is also discussed. P.Collins

541.1

9445. NOTE ON THE HELIUM-ION RADIOLYSIS PRODUCTS OF LIQUID ACETIC AND PROPIONIC ACIDS. A.S.Newton.
J. chem. Phys., Vol. 26, No. 6, 1764-5 (June, 1957).

Rigorously dehydrated acetic and propionic acid liquids were bombarded with 32 MeV helium ions and the increase in water content was measured in liquid and gas phases. It corresponded to G-values of 2.15 and 1.58 for the two acids respectively, values exceeded only for the yields of CO_2 (4.04 and 3.94 respectively). Water is thus a major product of radiolysis of the lower fatty acids. Previous (negative) attempts to identify it were made in the gas phase only, but water is soluble in these lower acids. This would account for the apparent increasing yield of water (in the gas phase) with increasing alkyl chain length. C.B.Allsopp

541.1

9446. RETARDATION OF A RADIOCHEMICAL REACTION BY CHARGE TRANSFER IN A BIMOLECULAR MIXTURE OF GASES. S.C.Lind and P.S.Rudolph.
J. chem. Phys., Vol. 26, No. 6, 1768-9 (June, 1957).

Addition of a small amount of benzene to a mixture of equal quantities of radon and acetylene reduces the rate of polymerization of the latter (at 100°C) by the α-particles from the former by over 30%. C.B.Allsopp

541.1

9447. RESISTANCE OF TERPHENYLS TO HEAT AND RADIATION. E.L.Colichman and R.F.Fish
Nucleonics, Vol. 15, No. 2, 72-4 (Feb., 1957).

Samples of ortho, meta and para terphenyl were irradiated at 400°C and 450°C by a 1 MeV electron beam. The polymerization resulting from doses up to 90 Whr/g was compared with that produced by heat alone; the radiation damage is about 30 times that due to pyrolysis. G values for the formation of polymer were 0.02-0.06. P-terphenyl is the most stable isomer. R.D.Smith

541.183 : 537.311.3

ADSORPTION OF SODIUM IONS BY GERMANIUM SURFACES
See Abstr. 9185

CRYSTALLOGRAPHY 548

548.52

9448. WIDMANSTÄTTEN MORPHOLOGY. H.W.Paxton.
J. chem. Phys., Vol. 26, No. 6, 1769-71 (June, 1957).

Certain microstructural phases grow in solid—solid reactions in the form of plates, growth perpendicular to the plates being slow. Parts of a plane of the new growing lattice may be derived from a plane of the old lattice by small diffusionless displacements of the atoms, giving areas of "fit". New lattice can form in the areas of "misfit" only by diffusion-controlled processes. The growth of the new lattice is therefore slowest in those directions corresponding to planes of best fit between old and new lattices since the diffusion paths may here be longer. These ideas seem to be borne out by experimental results on the growth of Widmanstätten plates of α-iron from austenite. A.B.Lidiard

548.574

9449. OBSERVATIONS ON ETCHING OF GERMANIUM CRYSTALS. J.Auleytner, K.Godwood and J.Krilov.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 6, 639-42 (1957).

Germanium surfaces of various orientations were polished with carborundum and alundum and etched with CP4. Block structures formed, depending on the grain size of the polishing agent, and disappeared on continued etching, which then gave rise to conical etchpits. The pit density depended on the polishing and etching treatment. J.Franks

ATOMIC AND X-RAY CRYSTALLOGRAPHY 548.7

548.7

9450. A CRYSTAL FIELD OF ICOSAHEDRAL SYMMETRY. B.R.Judd.
Proc. Roy. Soc. A, Vol. 241, 122-31 (July 23, 1957).

It is shown that the crystalline electric field at a rare-earth ion in the double nitrates approximates to one possessing icosahedral symmetry. The effect of this on the energy level system of a rare-earth ion is investigated with the aid of group theory, and an application is made to the paramagnetic resonance in dysprosium double nitrate.

548

9451. ABSOLUTE VALUES OF PARAMAGNETIC RESONANCE ABSORPTION IN CRYSTALLINE COPPER SULPHATE. K.Sundaramma and G.Suryan.
Curr. Sci., Vol. 26, No. 3, 80-1 (March, 1957).

Absolute values are measured for the loss of a weighed single crystal of $CuSO_4.5H_2O$ in a paramagnetic resonance absorption experiment with manganous sulphate as an internal standard. Values of both peak and integrated losses are given for four magnetically important crystal directions. The Kramers—Kronig relation to between the loss and the susceptibility is shown to hold. D.H.Whiffen

548

9452. THEORY OF STRONG INTERACTION OF ELECTRON EXCITATIONS WITH LATTICE VIBRATIONS IN MOLECULAR CRYSTALS. I. E.I.Rashba.
Optika i Spektrosk., Vol. 2, No. 1, 75-87 (1957). In Russian.

Formulae are derived relating the energy and plane wave-functions of excited levels in these crystals due to lattice deformation. The interaction is examined for excitons in both molecular crystals and other three-dimensional systems with short-range forces. Energy-surface minima are shown by states with undeformed lattices and free excitons. L.Bow

54

9453. THEORY OF STRONG INTERACTION OF ELECTRON EXCITATIONS WITH LATTICE VIBRATIONS IN MOLECULAR CRYSTALS. II. E.I.Rashba.

Optika i Spektrosk., Vol. 2, No. 1, 88-98 (1957). In Russian.

The formulae from previous work (see preceding abstract) are extended for other types of molecular crystals and the forms of energy surfaces investigated. L.Bovey

548.7

9454. AN ELASTIC MODEL FOR LOCAL DEFECTS. J.Teltow.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 169-74 (1956). In German.

When a foreign ion enters a crystal lattice, it distorts the lattice in its neighbourhood and a study has been made to see whether this affects the free energy of the crystal. For this purpose, and to determine whether the distance apart of two such localized disturbances was important, a theoretical study has been made of a model consisting of two spheres embedded in an infinite elastic medium. The classical elastic theory does not indicate any significant forces between the spheres or points of disturbance. Even when the elastic properties of the medium and of the intruders differed widely, only small alternating forces were produced which decreased rapidly with the 7th power of the distance between the two disturbances and were insignificant compared with the other atomic binding forces. A.C.Whiffin

548.7

9455. STRUCTURE IMPERFECTIONS IN THE NEUTRON IRRADIATED LITHIUM FLUORIDE: THE SUBMICROSCOPIC CAVITIES. M.Lambert and A.Guinier.
C.R. Acad. Sci. (Paris), Vol. 244, No. 23, 2791-4 (June 3, 1957). In French.

Dimensions and concentrations of the cavities in lithium fluoride are determined by the low-angle X-ray scattering method as functions of the irradiation dose and the thermal annealing. J.Adam

548.7

9456. HELICAL DISLOCATIONS IN CaF_2 AND NaCl CRYSTALS. S.Amelinckx, W.Bontinck and W.Maenhout-van der Vorst.
Physica, Vol. 23, No. 3, 270-2 (March, 1957).

CaF_2 crystals "as grown" were cleaved and the cleavage surfaces etched with sulphuric acid. Arrangements of etch pits corresponding to the intersection of the surface with helical dislocations were observed. Dislocations in NaCl doped with AgCl were decorated by annealing (reduction) in hydrogen at 500-600°C and polygonal helices were observed. Near the surface of the crystal the helices were noticably "pulled out" towards straight lines; this indicates that vacancies have distilled from the dislocation to the surface during annealing. A.B.Lidiard

548.7

9457. THE INFLUENCE OF HEATING GERMANIUM BY AN ELECTRIC CURRENT ON THE CONCENTRATION OF THERMAL ACCEPTORS. V.G.Alekseeva, V.N.Zobnina and I.V.Karpova.
Zh. tekh. Fiz., Vol. 27, No. 1, 215-17 (1957). In Russian.

Experiments involving heating single crystals of 10-50 ohm cm Ge with d.c. and a.c. to temperatures around 700° C lead to the following conclusions: thermal acceptors are impurity atoms which at temperatures above 700° C become mobile positive ions. Some of these diffuse out of the crystal, leaving the less mobile ones behind. Thermal acceptors are not lattice defects. A.F.Brown

548.7

9458. APPLICATION OF AN APPROXIMATE F-CENTER WAVE FUNCTION. MAGNETIC HYPERFINE INTERACTIONS IN KCl. F.J.Adrian.
Phys. Rev., Vol. 106, No. 6, 1356-7 (June 15, 1957).

The anisotropic magnetic hyperfine structure constants, a and b, have been calculated for the nearest neighbour ions in KCl. Comparison with the experimental measurements of Feher (Abstr. 5737/1957) indicates that the positive ion calculations are more reliable than those for the negative ions. Thus the calculated results in Mc/s are a (K^{39}) = 35, b (K^{39}) = 1.0 and a (Cl^{39}) = 12; Feher's results were a (K^{39}) = 21.6, b(K^{39}) = 0.95 and a (Cl^{39}) = 7.0. B.T.M.Willis

548.7

9459. M-CENTER SPIN RESONANCE AND OSCILLATOR STRENGTH IN LiF. N.W.Lord.
Phys. Rev., Vol. 106, No. 5, 1100-1 (June 1, 1957).

The spin resonance of M-centres induced in LiF by X-rays was differentiated from the known F-centre resonance and found to have a second moment of 10 500 gauss^2 and oscillator strength $f \cong 0.08$. D.H.Whiffen

548.7 : 535.34 : 535.35

ABSORPTION AND EMISSION OF LIGHT BY IMPURITY CENTRES. See Abstr. 9059

548.7 : 535.37

STABILITY OF F-CENTRES IN NaCl:Ni PHOSPHOR. See Abstr. 9101

548.7 : 539.4.016 : 537.311.31

INFLUENCE OF LATTICE DEFECTS ON THE ELECTRICAL PROPERTIES OF COLD-WORKED METALS. See Abstr. 9165-6

548.7 : 535.43 : 537.531

DISLOCATIONS IN GRAPHITE. See Abstr. 9226

548.7 : 539.374 : 539.219

THE INTERATOMIC BOND AND THE LATTICE DISTORTION IN THE CASE OF SOME Al- OR Ti-CONTAINING COMPOUNDS AND THEIR SOLID SOLUTIONS. See Abstr. 9423

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.732 : 539.371

9460. INTENSITY CHANGE OF X-RAY LINES ON DEFORMATION OF POLYCRYSTALS. B.I.Smirnov.
Zh. tekh. Fiz., Vol. 27, No. 1, 218-20 (1957). In Russian.

Results are presented of a study on the intensity change of X-ray lines when Armco iron polycrystals (cylinders 10 mm dia., 20 mm high, with 5 mm broad plane on the lateral surface) were deformed. Each successive deformation amounted to a few per cent, the total deformation being about 30%. It was found that, beyond the fluidity plateau, the intensity of all X-ray lines tested [(110), (220), (200), (211)] first increased; later, the intensity of the (200) line decreased, whereas those of other lines, sometimes after a marked initial increase, remained later practically stationary. The I_{220}/I_{110} intensity ratio first slightly decreased, and later remained constant. A tentative explanation of these changes is given. F.Lachman

548.733 : 548.735.4

9461. COUNTER DIFFRACTOMETER — THE EFFECT OF VERTICAL DIVERGENCE ON THE DISPLACEMENT AND BREADTH OF POWDER DIFFRACTION LINES. E.R.Pike.
J. sci. Instrum., Vol. 34, No. 9, 355-63 (Sept., 1957).

The "vertical" divergence of the beam in a counter diffractometer causes a broadening, and a shift of centre of gravity, of diffraction lines. The effects do not disappear as 2θ tends to 180°, and hence present extrapolation methods fail to remove the errors introduced. Experimental results are quoted that are not explained by previous treatments, and a theoretical investigation is made of the diffractometer with no Soller slits, one set of slits, and two sets of slits. Results show a marked asymmetry about $2\theta = 90°$, both in shift of centre of gravity and in line broadening the maximum effects occurring at low values of 2θ. The use of Soller slits for various practical applications of the diffractometer is discussed. For accurate lattice-parameter measurement it is shown that the fractional error in spacing introduced by vertical divergence may be written in the form

$$\Delta d/d = -a + b \cos^2\theta$$

where a and b are positive constants depending on goniometer radius, specimen height, and Soller-slit aperture (if used). Extrapolation against $\cos^2\theta$ and addition of the constant a will therefore give the true lattice spacing. The magnitude of the correction for a "Norelco" high-angle goniometer with two sets of Soller slits is approximately 4 parts in 10^5. A.

548.735

9462. DETERMINATION OF THE MOSAIC STRUCTURE OF THE CRYSTALS OF ANNEALED MARTENSITE BY MEANS OF THE ELECTRON MICROSCOPE. A.Mašín.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 257-61 (1956). In German.

The mosaic structure of annealed martensite crystals has been studied in the electron microscope by means of the Formvar replica technique. Specimens annealed in the range 550° C to 700° C showed no variation in mosaic structure and are therefore very stable. The growth of the crystals is connected with the number of mosaic blocks. T.Mulvey

548.735

9463. X-RAY STUDIES ON CsCl, CsBr, AND CsCl–CsBr SOLID SOLUTIONS. V.Hovi.
Ann. Univ. Turku. AI, No. 26, 8 pp. (1957).

Measurements of lattice parameter show a linear variation with composition, and the sharpness of Debye–Scherrer lines shows that the solutions were highly homogeneous. This work was done in connection with work on the heat of formation (Abstr. 4937/1950; Hovi, Acta Metallurgica, 1957, to be published). A.R.Stokes

548.735 : 537.311.23 : 537.226.1

ELECTRICAL PROPERTIES OF CRYSTALS AND PARAMETERS OF THE CRYSTAL LATTICE. See Abstr. 9151

548.735.7

9464. ON THE POSSIBILITY OF A COMPLETE X-RAY ANALYSIS OF THE DISPERSION OF GRAPHITE POWDERS AND COLLOIDAL PREPARATIONS. L.A.Feĭgin and V.N.Rozhanskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 5, 1102-5 (1957). In Russian.

X-ray methods for determining the average crystallite size from line broading measurements are well known. The more general problem of determining the distribution of crystallite size in metals is beset by technical difficulties. The authors apply the method of Fourier analysis of the measured line intensity to the more favourable case of powdered graphite with a view to obtaining the complete distribution of particle size. The results are compared with experimental data obtained by X-ray diffraction using carefully prepared graphite samples of known dispersion. Good agreement is obtained. T.Mulvey

548.736.1

9465. PARAMETER OF DISORDER p AND THE INTERLAYER DISTANCE d_{002} IN HIGHLY GRAPHITISED ARTIFICIAL GRAPHITES. M.Lefeld.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 5, 497-500 (1957).

The shape of the (112) line in the X-ray diffraction pattern from various samples of artificial graphites and from a sample of Ceylon graphite, has been examined. A parameter p (which is related to the intensity and the spacing d) is calculated by comparing the observed line shape with a theoretical one. It is shown that there is a linear relationship between this parameter p (i.e. the degree of disorder) and the value of the spacing d_{002}; the value of d_{002} decreases as the disorder decreases (see Abstr. 6580/1951). J.Iball

548.736.3 : 539.89

9466. AN INVESTIGATION OF THE CRYSTAL STRUCTURE OF RUBIDIUM HALIDES AT HIGH PRESSURE.
L.F.Vereshchagin and S.S.Kabalkina.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 4, 797-8 (1957). In Russian.

An X-ray investigation showed that: (a) RbI at 11 000 atm and RbCl at 7 500 atm have CsCl-type structures (a = 4.29 and 3.82 A respectively, at 25°C); (b) the volume changes for the NaCl → CsCl transformation are 0.045 cm^3/gm for RbCl and ~ 0.036 for RbI.
See also Phys. Rev., Vol. 54, 468-74 (1938). C.H.L.Goodman

548.736.3 : 539.213

STRUCTURE OF TELLURIUM OXIDE GLASS. See Abstr. 9420

548.736.4 : 535.343

9467. POLYNUCLEAR METAL CARBONYLS. III. INFRARED ANALYSIS OF IRON TETRACARBONYL. L.F.Dahl and R.E.Rundle.
J. chem. Phys., Vol. 27, No. 1, 323-4 (July, 1957).

For Pt II see Abstr. 8948 (1957). Results indicate that some carbonyls are associated with more than one iron in the crystalline state but whether this is via conventional bridges or not is not clear. G.I.W.Llewelyn

548.73

9468. THE STRUCTURE OF CADMIUM CHLORIDE (DI) ACETAMIDE. L.Cavalca, M.Nardelli and L.Coghi.
Nuovo Cimento, Vol. 6, No. 2, 278-85 (Aug., 1957). In Italian.

The results of a structural study on $CdCl_2(CH_3CONH_2)_2$ show that the cadmium atom coordinates planarly two chlorine atoms and two acetamide molecules; the coordinated atoms lie on the corners of a slightly distorted square. The coordination is octahedral if one considers that each chlorine atom is nearly at the same distance from two adjacent cadmium atoms. A

548.7

9469. THE NEUTRON DIFFRACTOMETER OF THE JOINT ESTABLISHMENT FOR NUCLEAR ENERGY RESEARCH AT KJELLER, NORWAY. J.A.Goedkoop.
Ned. Tijdschr. Natuurkde, Vol. 23, No. 5, 140-1 (May, 1957). In Dutch.

The neutrons are collimated to within about 1° horizontally and monochromatized by reflection from the (111) plane of a lead single crystal, to give a wavelength of about 1 A. A BF_3 counter is used for detection, employing B^{10}. The usual shielding precautions are observed. Either single crystals (mounted in a standard goniometer) or powders can be examined. Point counting is used. Powders of CuH and Al_2Th have been examined, as well as single crystals of HgO and $Ca(H_2PO_2)_2$. J.Thewlis

548.7

9470. THE RECORDING OF ELECTRON DIFFRACTION PATTERNS FROM SINGLE CRYSTALS USING THE METROPOLITAN-VICKERS TYPE E.M.3 ELECTRON MICROSCOPE. R.E.Burge, H.R.Munden and C.D.Curling.
J. sci. Instrum., Vol. 34, No. 8, 305-6 (Aug., 1957).

The design and construction of two additions to the Metropolitan-Vickers Type E.M.3 electron microscope which are useful in the study of the electron diffraction by single crystals are described. One addition, an adjustable rectangular diffraction aperture, is used to reduce the diffraction area selected at the specimen to a minimum while the other, two pairs of deflector plates at right angles to which saw-tooth waveform voltages are applied, is useful in the accurate measurement of the intensities in single crystal patterns.

GEOPHYSICS 55

ATMOSPHERE. METEOROLOGY 551.5

550.382

9471. INTERNATIONAL CONFERENCE ON ROCK MAGNETISM.
Advances in Phys., Vol. 6, 147-246 (April); 247-363 (July, 1957).

These two issues of "Advances in Physics" are devoted to the papers delivered at the International Conference on Rock Magnetism held in London in November 1956. The 22 papers present field and laboratory studies on rock magnetism, and include the results and interpretation of measurements made at many different parts of the globe.

550.385

9472. COMPARISON BETWEEN THE CHAPMAN AND FERRARO THEORY OF AN IONIZED CLOUD AND THE RECORDING OF THE COMMENCEMENT OF A MAGNETIC STORM. J.L.Bureau.
C.R. Acad. Sci. (Paris), Vol. 244, No. 10, 1396-8 (March 4, 1957). In French.

Electromagnetic variometer recordings made at Tamanrasset (22.8° N, 5.5° E) show that the north-component of the earth's magnetic field undergoes a characteristic variation during sudden-commencement (s.c.) magnetic storms. With various simplifying assumptions, an analysis of these changes during the comparatively rapid first phase of such storms on the basis of the Chapman–Ferraro ionized-cloud theory allows conclusions to be drawn regarding the magnetic effects of the front-layer of the advancing ionized cloud. Results suggest that the mechanism responsible for the initial phase of s.c. magnetic storms may be the same as that operative during the commencement of magnetic bays. G.M.Brown

551.508.2

9473. TWO PORTABLE THERMISTOR RADIOMETERS.
W.H.Ward.
J. sci. Instrum., Vol. 34, No. 8, 317-21 (Aug., 1957).

The construction and calibration of two portable radiometers, suitable for micrometeorological studies, is described. One instrument measures the hemispherical short-wave radiation and the other measures directly the total radiative flux through a plane. Attachments to the latter instrument permit total hemispherical radiation and psychometric measurements to be made. Small dry batteries, a tiny motor, a simple Wheatstone's bridge and thermistors are used.

551.508.8 : 551.594

9474. A NOTE ON DESIGN CONSIDERATIONS FOR A PROPOSED AURORAL RADAR. N.Wax.
Chalmers Tekn. Högsk. Handl., No. 182, 16 pp. (1957).

The design is considered of a range-gated pulsed Doppler radar system, which will achieve fine resolution in range, azimuth and elevation at a frequency up to 100 Mc/s, while retaining the ability to scan an extented part of the sky. It is believed that some of the various proposed models of auroral reflection, a summary of which is given in the paper, can be tested experimentally by an examination of the fine structure of auroral echoes. G.M.Brown

551.510.535

9475. THE MEAN THICKNESS OF NIGHT-TIME E_s CLOUDS AT BRISBANE. R.H.Hosking.
Austral. J. Phys., Vol. 10, No. 1, 220-1 (March, 1957).

The mean of 98 measurements of the thickness of the Esc clouds (night-time patches of Es which maintain an almost constant height) at Brisbane during 1952-54 was 0.33 km, with a standard deviation of 0.23 km. This confirms that this type of Es is very thin.

G.M.Brown

551.510.535 : 538.566.3

THE MAGNETO-IONIC THEORY AND ITS RESULTS. See Abstr. 9281-2

551.510.535 : 538.566.3

CERTAIN PROBLEMS OF IONOSPHERIC PHYSICS. See Abstr. 9284

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.576.1

9476. THEORY OF EVAPORATING WATER CLOUDS. R.H.Milburn.
J. Colloid Sci., Vol. 12, No. 4, 378-88 (Aug., 1957).

The mass and heat transfer processes within finite clouds of water droplets are studied. Vapour concentration, temperature, and droplet size are described by continuous field functions. A simple nonlinear differential equation is developed to govern the propagation of these fields in space and time. Solutions of an approximate linear equation are found in order to describe the initial stages of cloud evaporation and to illustrate two different types of boundary condition. A.

551.591.1

9477. THE VISIBILITY OF LUMINOUS SOURCES IN FOG. EFFECT OF THE LUMINANCES OF NATURAL LIGHT. J.Olivier.
Rev. Opt., Vol. 36, No. 3, 105-31 (March, 1957). In French.

A theoretical treatment of the problem of detecting discrete bright sources of light (airport beacons) against the diffusely illuminated sky-background in fog. The effects of both direct and scattered solar radiation within the fog zone are considered separately, and equations are derived by means of which, to a first approximation, valid calculation of (1), energy transmission through a diffusing layer; (2) luminance and albedo of cloud-layers; and (3) oblique visibility from aircraft, may be made. Some examples of the above are cited.

D.R.Barber

551.593.12 : 778

9478. SOME EFFECTS OF TURBULENCE ON PHOTOGRAPHIC RESOLUTION. A.G.Smith, M.J.Saunders and M.L.Vatsia.
J. Opt. Soc. Amer., Vol. 47, No. 8, 755-7 (Aug., 1957).

Laboratory experiments showed that the extent to which localized turbulence degrades photographic resolution is markedly dependent upon the location of the disturbance along the optical path. The experiments indicate that the mean resolving power under such conditions increases with shutter speed. Comparable measurements made over outdoor ranges under average daytime conditions show that resolution increases with shutter speed at short distances, but becomes essentially independent of exposure time when the optical path is very long. A.

BIOLOGY 57/59

MEDICAL SCIENCE. HUMAN PHYSIOLOGY

61

612.843.613

9479. EFFECT OF RETINAL IMAGE MOTION ON CONTRAST THRESHOLDS FOR MAINTAINED VISION. J.Krauskopf.
J. Opt. Soc. Amer., Vol. 47, No. 8, 740-4 (Aug., 1957).

Contrast thresholds for maintained vision were determined under conditions of retinal image motion. The "stopped image" technique was used to eliminate normal image motion. Controlled motion at various frequencies and amplitudes was introduced by rotating one of the mirrors in the optical system. Low-frequency vibrations (1, 2, and 5 c/s) of the retinal image were found to be beneficial to maintained vision while high-frequency vibrations (10, 20, and 50 c/s) were found to be detrimental to maintained vision when compared to vision in the absence of normal retinal image motion. A.

612.844.24

9480. ACCOMMODATION MEASUREMENTS IN EMPTY VISUAL FIELDS. G.Westheimer.
J. Opt. Soc. Amer., Vol. 47, No. 8, 714-18 (Aug., 1957).

Accommodation is measured by flashing into one eye for 0.05 sec every 10 sec a beam whose configuration indicates whether the subject's eye is over-accommodated, under-accommodated, or correctly accommodated for the measuring level. The exposure of the measuring beam is short enough not to contaminate the results with accommodative responses to it. Changes in accommodation can thus be followed by a bracketing procedure. The visual stimulus presented to the eye is an empty field, both a completely dark one and one with a bright central area without sharp contours. The eye responds to this kind of stimulation by a fluctuating level of accommodation, with an average level of a little over 1D and with peak-to-trough amplitude of the oscillations of up to 1D, the most prominent period of the fluctuations being about two minutes. Harmonic analysis reveals that, while individual accomodation—time curves show strong frequency bands, there are no characteristic frequencies either for an observer or for a stimulus situation. A.

612.845 : 535.832

9481. NEW METHODS OF RATING AND PRESCRIBING MAGNIFIERS FOR THE PARTIALLY BLIND.
L.L.Sloan and A.Habel.
J. Opt. Soc. Amer., Vol. 47, No. 8, 719-26 (Aug., 1957).

The conventional formula for the increase in size of the retinal image provided by a simple magnifier is M = D/4. This formula is based on arbitrary assumptions as to the accommodative powers exerted when the observer views a near object with and without the magnifier. Since these assumptions do not apply in a majority of cases, the conventional ratings of magnification are of limited use in the prescribing of reading aids for patients with subnormal vision. More realistic formulae are proposed which are applicable to many special cases, and which take account of the fact that the increase in size of the retinal image may depend upon the way in which the magnifier is used. It is shown that the dioptric power of the magnifier required by a given patient is determined primarily by (a) his visual acuity and (b) his near point of distinct vision. A simple test of near-acuity for meaningful text is described which gives direct and valid information as to the increase in size of the retinal image required for useful reading vision. Further studies are needed to determine the best method of measuring the accommodative power of patients with subnormal vision. A.

TECHNIQUE. MATERIALS 62/69

666.1 : 539.319

INTERNAL STRESSES IN HARDENED GLASSES. See Abstr. 9432

669.782.4

9482. A SHOT TOWER FOR PRODUCING GERMANIUM DOPING PELLETS OF UNIFORM COMPOSITION. I.A.Lesk.
J. Electrochem. Soc., Vol. 103, No. 11, 601-3 (Nov., 1956).

A shot tower may be used as a convenient and accurate way to obtain uniform mixtures of Ge and an impurity in a finely divided form. This shot may be used as master alloys for controlled impurity addition during growth of Ge crystals. This method gives convenient small pellets with the impurity fraction in each pellet (in a given batch) the same. The impurity fraction in a given batch of shot is easily controlled. The size range can be controlled, facilitating subsequent weighing procedures. Insoluble materials in the melt, e.g., carbon dust, are left behind, and there is no need to etch the shot. A.

PHOTOGRAPHY 77

778.16

9483. ELECTROPHOTOGRAPHY USING PHOSPHORS.
V.M.Fridkin and T.N.Gerasimova.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 3, 571-2 (1957). In Russian.

A preliminary report on Electrofax type processes (see Abstr. 2409B/1955, RCA Rev., Vol. 15, No. 4, 469-84, Dec., 1954) using (CdS,ZnS)Cu or (CdS,ZnS)Ag in phenol-formaldehyde resin as sensitive medium. The latent image (L) in the precharged coating (on paper or metalbase) was produced by light from a 200 watt incandescent lamp, and was developed with triboelectrically charged pigment particles subsequently thermally bonded to the resin. L could be viewed as a fluorescent image under 3650 A radiation. Similar electrophotographs were also obtained with ZnO and CdS coatings. C.H.L.Goodman

778.33

9484. AN EXPOSURE CALCULATOR FOR ISOTOPE RADIOGRAPHY. T.A.Cosh.
J. sci. Instrum., Vol. 34, No. 8, 329-33 (Aug., 1957).

The factors affecting exposure time in gamma radiography using radon, Co^{60}, Ir^{192}, Tm^{170}, Cs^{137} are correlated so that for any stated conditions the exposure time is rapidly determined. While primarily designed for the radiography of steel the use of thickness conversion scales enables the calculator to be used to determine the exposure time for other materials. A.

778.34 : 77.023.4

9485. STUDY OF THE CHARACTERISTICS OF PHOTOGRAPHIC EMULSIONS EXPOSED TO CONSTANT FLUXES OF ELECTRONS OR OF LIGHT. P.Vernier.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3047-50 (June 17, 1957). In French.

A statistical model is used to compare experimental results obtained for various commercial emulsions with those predicted on theoretical grounds. It is shown that although on the average nuclear emulsions yield one developable grain for each incident electron, at least two photons are required to produce a developable grain in optical exposures. The marked difference between the latter prediction, and the experimental fact that 200 to 1000 photons are needed to produce a grain of developed silver is explained as a direct consequence of the inability of the exposed grain to absorb more than a very small fraction of the incident light. D.R.Barber

778.34

9486. A STUDY OF THE FLUCTUATIONS OF TRANSPARENCY IN PHOTOGRAPHIC PLATES EXPOSED TO ELECTRONS.
P.Vernier.
C.R. Acad. Sci. (Paris), Vol. 245, No. 4, 416-19 (July 22, 1957). In French.

Experimental data obtained for Ilford C2 and G5 nuclear emulsions are examined statistically and the results are interpreted in terms of a theoretical model of the exposed and processed photographic layer. Using this model the optimal conditions for exposing photographic emulsions in an electronic telescope are derived. D.R.Barber

778.34 : 537.533.7

THE APPLICATION OF NUCLEAR EMULSIONS TO THE STUDY OF β-PARTICLES. See Abstr. 9236

778.34 : 539.1

APPLICATION OF THE KLAUSEN MICROMETER TO THE MEASUREMENTS OF MULTIPLE SCATTERING OF ELEMENTARY PARTICLES IN NUCLEAR EMULSIONS. See Abstr. 9413

778.3

9487. HIGH SPEED PHOTOGRAPHY.
J.S.Courtney-Pratt and D.P.C.Thackeray.
J. photogr. Sci., Vol. 5, No. 2, 32-42 (March-April, 1957).

This is a review of apparatus developed at Cambridge. A drum camera is described having time resolution of $\frac{1}{4}$ μsec. Image dissection devices take a few hundred frames at rates up to 250 000 per sec and magnifications up to x 500. Image splitting techniques with exposure times as short as 1 μsec enable eight frames to be obtained at rates up to 10^6 per sec. Image converter tubes can be used for single exposures of a few millimicroseconds or up to 200 frames at 50 000 per sec and exposure times of a few microseconds. Cathode-ray tubes are used for short duration light pulses and a delay line extends the pulse duration of a flash tube to 1.2 milliseconds. E.R.Woodin

AUTHOR INDEX

Abbitt,W.H., 9062
Abraham,M., 9334
Achari,R., 9324
Adrian,F.J., 9458
Agranovskaya,A.I., 9157, 9159
Airapetyants,A.V., 9201
Alekseeva,V.G., 9457
Aléonard,R., 9269
Al'pert,Ya.L., 9284
Alphonce,R., 9382
Alvial,G., 9413
Amati,D., 8991
Amble,E., 9088
Ambler,E., 9257
Amelinckx,S., 9456
Andrä,W., 9258
Anikina,M.P., 9397
Arkhangel'skaya,V.A., 9078
Aron,A., 9207, 9374
Arzeliès,H., 8975
Atkinson,H.H., 9431
Auleytner,J., 9226, 9449
Austern,N., 9309
Austin,I.G., 9180
Aymard,A., 9001
Aziz,R.A., 9429

Bacon,G.E., 9267
Baillard,G., 9042
Baker,D., 9435
Baranskiĭ,P.I., 9186, 9205
Barbier,J.C., 9269
Barker,F.C., 9391
Barkov,L.M., 9406
Barloutaud,R., 9322, 9332
Barnard,A.C.L., 9368
Barron,T.H.K., 9287
Bartley,A.J., 9022
Basile,R., 9389
Basil'kovskiĭ,A.A., 9107
Bastin-Scoffier,G., 9355
Bates,D.R., 9348
Beeler,R., 9341
Bel,L., 8981
Bella,F., 9242
Bellicard,J.B., 9356, 9360
Benoît,H., 9335
Berg,D., 9153
Bergmann,P.G., 8978, 9146
Berkowitz,B.J., 9057
Berz,F., 9217
Bhaumik,M.L., 9102
Biedenharn,L.C., 9308
Bir,G.L., 9197
Birdsall,H.A., 9152-3
Bisi,A., 9358
Bizette,H., 9268
Bloch,C., 9377
Bloem,J., 9103
Bloembergen,N., 9289
Bloomer,R.N., 9037-8
Bockris,J.O'M., 9030
Boeschoten,F., 9167
Bogomolov,V.N., 9133, 9171
Bontinck,W., 9456
Booker,C.J.L., 9427
Bopp,F., 9011
Borisovskiĭ,E.S., 9169
Börner,H., 9050
Bose,H.N., 9102
Bosgra,S.J., 9417
Bouriau,Y., 9119
Brady,G.W., 9420
Broude,V.L., 9083
Brown,G., 9414
Brown,W.B., 9029
Browne,T.C., 9152
Bruin,F., 9409-10
Bruin,M., 9409-10
Buck,T.M., 9183
Budini,P., 8989
Budzanowski,A., 9297
Bugaĭ,A.A., 9426
Bullock,F.W., 9243
Bunney,L.R., 9376
Burcham,W.E., 9381
Bureau,J.L., 9472
Burge,R.E., 9470

Caianiello,E.R., 8990
Calhoun,B.A., 9153
Califano,S., 9085
Camia,F., 9127-9
Campbell,G., 9155
Cap,F., 9012, 9280
Carrara,N., 9087
Catalan,M.A., 9067
Cavalca,L., 9468
Cayless,M.A., 9245, 9252
Chandrasekhar,S., 9139-40
Charru,A., 9285
Chase,D.M., 9314
Chernikov,N.A., 9007
Chevalerias,R., 9115
Cimbleris,B., 9400
Clemmow,P.C., 9040
Clerc,H.G., 9182
Clouston,J.G., 9045
Codd,J., 9401
Coghi,L., 9468
Colichman,E.L., 9447
Cook,W.R.,Jr, 9152-3
Cosh,T.A., 9484
Cosslett,A., 9092
Cosslett,V.E., 9092
Cottin,M., 9347
Courtney-Pratt,J.S., 9487
Couture,L., 9077
Cox,J.T., 9111
Craggs,J.D., 9248
Crawley,D.J., 9034
Crowe,R.W., 9152
Crowe,R.W.(Ed.), 9152-3
Curling,C.D., 9470

Dahl,L.F., 9467
Dallaporta,N., 9415
Davies,H., 9016
de Groot,S.R., 9403
de Henau,A., 9324
Dekker,A.J., 9237
Dellis,A.N., 9211
Demuynck,J., 9351
Denisov,N.G., 9279
de Nobel,J., 9198
Desjonqueres,J., 9246
D'Espagnat,B., 8993,9408
Destouches-Aeschlimann,F., 9052
Deutsch,F., 9025
de Vries,D.A., 9150
de Waard,H., 9364
Diehl,P., 9337
Di Vita,S., 9153
Dmitriev,V.A., 9241
Dobrer,E.K., 9160
Dodd,C., 9243
Dognin,A., 9132
Doil'nitsyn,E.F., 9238
Dolce,A., 9193-4
Donnelly,R.J., 9139
Dontsov,Yu.P., 9060
Douglas,A.S., 9344
Downing,A.C., 9438
Drabble,J.R., 9175
Drummond,L.J., 9045
Dumontet,P., 9113
Dunmur,I.W., 9267
Durkina,A.V., 9072
Dzhelepov,B.S., 9372
Dzurus,M.L., 9190

Eaton,W., 9033
Eckart,F., 9154, 9251
Efremov,C.P., 9068
El Bedewi,F.A., 9388
Elliott,K.W.T., 9024
El Wahab,M.A., 9388
Emanuel',N.M., 9444
Endt,P.M., 9385
Eppley,M., 9054
Epstein,D.J., 9152
Eremenko,V.V., 9083
Ershler,B.V., 9397
Eugster,H.P., 9439
Euranto,E.K., 9310
Evans,J.E., 9396

Fabrikant,V.A., 9340
Faget,J., 9233
Fedorov,F.I., 9122-4
Feĭgin,L.A., 9464
Feix,M., 9399
Feld,B.T., 8997
Feofilov,P.P., 9078
Ferguson,E.T., 9260
Ferrari,F., 9415
Ferretti,B., 9004
Fert,C., 9233
Fessler,H., 9434
Fiorini,E., 9244
Fish,R.F., 9447
Focardi,S., 9242
Fonda,L., 8989
Forster,L.S., 9093
Forster-Brown,A.D., 9245
Fradkin,É.E., 9003
Freiling,E.C., 9376
Fridkin,V.M., 9483
Friedel,J., 9162
Friedlander,M.W., 9407
Frish,S.É., 9061
Froese,C., 9345
Frost,D.C., 9249

Gabovich,M.D., 9218
Gaman,V.I., 9151, 9170
García-Riquelme,O., 9066
Garkunov,D.N., 9436
Garrigue,H., 9349
Garstang,R.H., 9346
Gaulard,M.L., 9044
Gautier,P., 9276
Gavrilov,F.F., 9068
Gel'bukh,L.A., 9274
Gel'd,P.V., 9131
Geller,R., 9246
Geodkoop,J.A., 9469
Gerasimova,T.N., 9483
Gerholm,T.R., 9325
Germagnoli,E., 9358
Gershman,B.N., 9279
Giaconi,R., 9244
Giambiagi,J.J., 9380
Gibbons,J.E., 9152-3
Gibson,W.M., 9381
Ginzburg,V.L., 9279
Glover,R.N., 9350, 9361
Godwood,K., 9449
Goes,M.L., 9324, 9352 9371
Goldin,L.L., 9230
Goldstein,L., 9028
Golik,A.Z., 9031
Gontier,G., 9114
Goodman,B.B., 9141
Goodman,C.H.L., 9180
Gorbatyĭ,N.A., 9231
Gorter,C.J., 9198
Gotlib,Yu.Ya., 9120
Grace,M.A., 9363
Gregory,R.W., 9022
Grenishin,S.G., 9079
Grodstein,G.W., 9229
Gromov,V.A., 9216
Gross,E.P., 9039
Grotowski,K., 9297
Grunwald,E., 9057
Guenther,A.H., 9065
Guillaud,C., 9261
Guinier,A., 9455
Günther,K.G., 9035
Gurevich,V.L., 9189
Gurvich,L.V., 9304

Habel,A., 9481
Hamilton,C.W., 9153
Hänlein,W., 9035
Harrand,M., 9089
Hart,J., 9152-3
Haseda,T., 9270
Hass,G., 9111
Hayman,H.J.G., 9025
Haynes,S.K., 9360
Haywood,B.C., 9368
Heckscher,H., 9104
Hees,G.W., 9033
Heine,V., 9292-4
Henderson,C., 9243
Henin,F., 9020
Hennig,G.R., 9190
Herpin,A., 9265
Herrlander,C.J., 9325
Herzenberg,A., 9312
Hiebert,G.L., 9135
Hoffman,J.D.(Ed.), 9153
Hofman,D., 9156
Holland,L., 9428
Holm,C.H., 9302
Holthuizen,D.J., 9417
Hornberg,H., 9221
Hornig,D.F., 9135
Hosking,R.H., 9475
Hovi,V., 9463
Hudson,R.P., 9257
Hughes,I.S., 9414
Huguenin,E.L., 9232
Huiszoon,C., 9167
Hunter,W.F., 9045

Ibers,J.A., 9302
Iglesias,L., 9066, 9069
Ilisavskiĭ,Yu.V., 9133
Imaeda,Y., 9303
Imhof,W., 9416
Indenbom,V.L., 9432
Infeld,L., 8974
Ishii,T., 9378
Isupov,V.A., 9157, 9159
Izmaĭlov,S.V., 9003

Jabłoński,A., 9095
Jackson,E.A., 9039
Jacques,R., 9339
Jaffe,H., 9152-3
Jaffe,J.H., 9056
Jakobi,G., 9002
Jancel,R., 9213-14
Janik,J.A., 9297
Jánossy,L., 8976
Janz,G.J., 9147
Jatar,D.P., 9215
Jeffries,C.D., 9334
Jerrard,H.G., 9121
Johansson,A., 9382
Johnson,C.E., 9363
Joki,E.G., 9396
Jones,H., 9143
Jones,L.H., 9081-2
Jonker,C.C., 9419
Jordan,P., 9421
Judd,B.R., 9450

Kabalkina,S.S., 9466
Kabanov,A.N., 9234
Kachurin,L.G., 9134
Kagan,W., 9261-2
Kahan,T., 9213-14
Kalmus,G., 9243
Kanda,E., 9270
Kaplan,M., 9424
Kard,P.G., 9109-10
Karlikov,D.N., 9031
Karmen,K.N., 9160
Karoli,A.R., 9054
Karpova,I.V., 9457
Karpovich,I.A., 9200
Kaschluhn,F., 9288
Kästner,S., 9046
Kawai,K., 9299
Kedzie,R.W., 9334
Kegel,G., 9375
Kenney,R.W., 9416
Kerwin,L., 9347
Kind,A., 9307
Kischel,K., 9210
Kislovskiĭ,L.D., 9105-6
Kitaĭgorodskiĭ,I.I., 9432
Kizel',V.A., 9108
Klechkovskiĭ,V.M., 9343
Klein,R., 9335
Kleppa,O.J., 9424
Knapp,E., 9416
Kogan,A.V., 9240
Kôi,Y., 9303
Kolesnikov,N., 9002
Kolos,W., 9300-1
Komar,A.P., 9266
Kontorova,T.A., 9176
Kornfel'd,M., 9133
Kosenko,V.E., 9426
Koškarev,D.G., 9230
Kothari,L.S., 9418
Koukila,J., 9310
Kozlowitz,I., 9371
Kragel'skiĭ,I.V., 9436
Kraitchman,J., 9153
Krauskopf,J., 9479
Krilov,J., 9449
Krivko,N.I., 9266
Krizhanskiĭ,L.M., 9398
Krüger,F.A., 9103
Królikowski,W., 8998-9
Krýlova,T.V., 9188
Kucherenko,E.T., 9218
Kumar,R.C., 9411
Kümmel,F., 9209
Kuper,C.G., 9138
Kvasnikov,I.A., 9255-6

Lagasse,A., 9324
Lambert,M., 9455
Langevin,M., 9357
Langevin-Joliot,H., 9353, 9367
Lanius,K., 9379
Lasich,W.B., 9411
Latapie,C., 9316
Latron,Y., 9115
Lawson,R.D., 9329
Lazarev,A.N., 9084
Lebowitz,J.L., 9146
Lech,J., 9033
Lee,L.L.,Jr, 9319
Lee,P.A., 9173
Lefeld,M., 9226, 9465
Le Gallic,Y., 9365
Lehmann,P., 9322, 9332
Lely,J.A., 9156
Lenoble,J., 9119
Lépéchinsky,D., 9281-2
Les,F., 9073
Lesk,I.A., 9482
Lévêque,A., 9322, 9332

Lévi,C., 9316
Levine,H., 9049
Levinger,J.S., 9309
Levinson,I.B., 9058
Levintov,I.I., 9387, 9394
Lim,T.G., 9417
Lind,S.C., 9446
Lindqvist,T., 9318
List,G., 9222
Löcherer,K.H., 9130
Lord,N.W., 9459
Lord,P., 9027
Lord,R.C., 9074
Loskutov,Yu.M., 8994
Lowde,R.D., 9431
Lubchenko,A.F., 9059,9075
Lucasson,P., 9164, 9402
Lushchik,Ch.B., 9100
Lye,R.G., 9237
Lyon,R.H., 9047
Lyuttsau,V.G., 9433

MacAdam,D.L., 9126
McCrea,W.H., 9278
McCubbin,T.K., Jr, 9074
MacDonald,D.K.C., 9203
McDowell,C.A., 9249
MacDowell,S.W., 9380
McElcheran,D.E., 9347
McIsaac,L.D., 9376
Macke,W., 9315
McKim,F.S., 9183
McWeeny,R., 9305
Maenhout-van der Vorst,W., 9456
Majewski,M., 9342
Makhalov,Yu.A., 9177
Malyĭ,Ya., 9398
Mande,C., 9227
Mandel'shtam,S.L., 9071
Maniawski,F., 9297
Marcus,R.J., 9144
Marder,L., 8973
Margolis,B., 9320
Marguin,G., 9236
Maris,T.A.J., 9383
Markgraf,H., 9043
Marklund,I., 9318
Marty,C., 9326
Marty,N., 9353, 9367
Mash,D.I., 9286
Mashovets,T.V., 9187
Mašín,A., 9462
Matskevich,T.L., 9235
Maude,A.D., 9026
Mavrides,S., 8980
Mazing,M.A., 9071
Mazurin,O.V., 9169
Mendelssohn,K., 9137
Merat,P., 8983
Mériel,P., 9265
Mesnard,G., 9193-4
Milburn,R.H., 9476
Miller,A.V., 9387, 9394
Miller,R.C., 9152
Milyutin,V.I., 9234
Miselyuk,E.G., 9426
Mitra,A.N., 9253
Miyahara,K., 9440-1
Moccia,R., 9085
Mochan,I.V., 9188
Moĭzhes,B.Ya., 9149, 9178
Montilla,J., 9023
Mooser,E., 9179
Morita,M., 9369
Morrison,P., 9309
Mott,N.F., 9174
Mottl,J.R., 9247
Moussa,A., 9360
Müller,H., 9296
Munden,H.R., 9470
Murata,H., 9299
Murin,A.N., 9398
Myaé,É.A., 9338
Myers,H.P., 9272
Myuller,R.L., 9168

Nabarro,F.R.N., 9425
Nagao,S., 9220
Naggiar,V., 9393
Nambu,Y., 9010
Nardelli,M., 9468
Nataf,R., 9366
Nedoluha,A., 9163
Néel,L., 9271
Newton,A.S., 9445
Newton,J.O., 9317
Nicourd,P., 9399
Nielsen,J.R., 9086
Niewodniczański,H., 9073
Nikitine,S., 9070, 9076, 9094
Nikolaev,V.P., 9032
Nikolaeva,S.M., 9423
Nikol'skiĭ,B.A., 9406
Nisbet,A., 9277
Nishikawa,K., 9378

Obraztsov,Yu.N., 9188-9, 9202
Ofer,S., 9328
Ogata,H., 9369
Ogg,R.A., 9336
Okun',L., 9404
Olivier,J., 9477
Omnes,R., 9408
Onaka,R., 9298
Oppenheim,U., 9056
Ornatskaya,Z.I., 9192

Pachner,J., 8982
Palinchak,S., 9152-3
Papineau,L., 9316
Park,D., 9006
Paulevé,J., 9264
Paxton,H.W., 9448
Pearce,C.A.R., 9150
Pearson,W.B., 9179, 9203
Peaslee,D.C., 9311
Peker,L.K., 9331
Pengelly,A.E., 9180
Perez-Mendez,V., 9416
Perthel,R., 9258
Pesteil,P., 9080
Petiau,G., 9013
Petro,A.J., 9153
Philippot,J., 9019
Phillips,G.C., 9332, 9393
Philofsky,H.M.(Ed.), 9152
Pike,E.R., 9461
Pikus,G.E., 9197
Pirson,A., 9352
Pleasonton,F., 9373
Pochon,M., 9421
Poincelot,P., 9283
Polkinghorne,J.C., 8986
Poppema,O.J., 9364
Poulet,H., 9080
Power,B.D., 9034
Power,G., 9161
Prener,J.S., 9096
Prentki,J., 8993, 9408
Preobrazhenskiĭ,B.K., 9398
Preobrazhenskiĭ,R.K., 9098
Presnov,V.A., 9151, 9170, 9181
Prigogine,I., 9019-20
Prod'homme,L., 9118
Prowse,D.J., 9381
Puchkovskiĭ,V.V., 9225
Pursey,D.L., 8992
Puzikov,L., 9009

Quidort,J., 9332

Rabenhorst,H., 9154
Radicati,L.A., 9412
Raĭzer,M.D., 9338
Ramanathan,K.G., 9142
Rand,S., 9392
Rank,D.H., 9065
Rashba,É.I., 9083, 9452-3
Rasmussen,J.O., 9333
Rautian,S.G., 9116
Rebane,T.K., 9306
Reĭnov,N.M., 9240
Reiss,R., 9070, 9076
Reshetnikova,L.V., 9231
Respaut,M.T., 9125
Richards,N.E., 9030
Rico,F.R., 9067
Rimbert,F., 9263
Roberts,A.S., 9312
Roberts,J.P., 9422
Roberts,S., 9152-3
Roclawski-Conjeaud,M., 9393
Rodriguez,P.M., 9185
Rohner,E., 9064
Rosati,S., 9412
Rossetti,C., 9048
Rotblat,J., 9381
Roux,D., 9341
Rovinskiĭ,B.M., 9433
Rowntree,R.F., 9111
Roy,R.R., 9324, 9352, 9371
Rozgachev,K.I., 9340
Rozhanskiĭ,V.N., 9464
Rozovskiĭ,M.I., 9273
Ruamps,J., 9015
Rubbia,C., 9242
Rudolph,P.S., 9446
Rundle,R.E., 9467
Ryndin,R., 9009
Rŷvkin,S.M., 9177, 9187, 9201
Rżany,H., 9297
Rzewuski,J., 8985

Sack,R.A., 9018
Sakai,M., 9369
Saksena,G.D., 9065
Salam,A., 8993
Saunders,M.J., 9478
Saunier,N., 9316
Savornin,F., 9206
Sawicki,J., 9386
Scadden,E.M., 9376
Scarpati,R., 9085
Schiffer,J.P., 9319
Scholz,A., 9442
Schopper,H., 9362
Schützer,W., 9017
Schwartze,W., 9259
Schwetzoff,V., 9199
Scobie,J., 9359
Scott,G.D., 9429
Scurlock,R.G., 9363
Segrè,E., 8996
Semenova,O.P., 9072
Sen Gupta,S.N., 9405
Sergent,P., 9353
Shalyt,S.S., 9202
Shamshev,V.N., 9387, 9394
Sharbaugh,A.H., 9152
Sharma,H.D., 9215
Shcherbakova,M.Ya., 9238-9
Shearer,J.N., 9065
Sheremet'ev,G.D., 9097
Shotov,A.P., 9196
Shpigel',I.S., 9338
Shtenbek,M., 9186, 9205
Shuppe,G.N., 9231
Shuraleva,E.I., 9101
Sichirollo,A.E., 9244
Sidorov,É.A., 9437
Sieskind,M., 9094
Sikkema,C.P., 9395
Singwi,K.S., 9418
Sinha,M.S., 9405
Skyrme,T.H.R., 9384
Sliv,L.A., 9331
Sloan,L.L., 9481
Smirnov,B.I., 9460
Smith,A.G., 9478
Smith,C.F., 9063
Smith,J.H., 9267
Smith,M.S., 9396
Smith,R.R., 9396
Smith,T., 9055
Smoke,E.J., 9153
Smolenskiĭ,G.A., 9157-9
Smorodinsky,J., 9009
Snell,A.H., 9373
Sochava,L.S., 9133
Soderman,R.A., 9152-3
Sokolov,A.A., 8994
Sokolov,I.A., 9240
Sokol'skaya,I.L., 9191
Solodovnikov,A.A., 9079
Souriau,J.M., 8972, 9014
Sowter,C.V., 9363
Sparstad,T., 9088
Speroni,G., 9085
Srinivasan,T.M., 9142
Stanley,C.R., 9295
Stannard,F.R., 9411
Stantic,S., 9413
Starkey,T.V., 9026
Stebbings,R.F., 9250
Stelmakh,M.F., 9240
Stepanov,A.F., 9108
Stil'bans,L.S., 9208
Stoicheff,B.P., 9090-1
Stolz,H., 9172
Stratton,R., 9204, 9290
Street,R., 9267
Striganov,A.R., 9060, 9068
Strimple,J.H., 9152
Strominger,D., 9333
Strunin,R.I., 9133
Strutt,M.J.O., 9064
Suber,L.I., 9152
Suber,L.L., 9153
Succi,C., 9244
Sundaramma,K., 9451
Suryan,G., 9451
Svantesson,N.L., 9390
Sŷnorov,V.F., 9181
Sŷsoev,M.I., 9223
Sŷtaya,E.P., 9231
Szkatuła,A., 9197
Szteinsznaider,D., 9393

Tabor,H., 9025
Talmi,I., 9330
Tamm,I.E., 8977
Tarumov,E.Z., 9387
Taylor,J.C., 9291
Taylor,J.G., 8988
Teltow,J., 9454
Temperley,H.N.V., 9021
Terrier,C., 9268
Thackeray,D.P.C., 9487
Thaler,R.M., 9308
Theimer,R., 9086
Thénard,M., 9365
Thompson,W.B., 9212
Thorburn,R., 9248
Tibell,G., 9382
Tietz,T., 9342
Tinaut,D., 9023
Tkachuk,N.N., 9098
Tokunaga,S., 9378
Tolansky,S., 9430
Tolhoek,H.A., 9403
Toll,J.S., 9005
Tolstoĭ,N.A., 9098-9
Torelli,G., 9242
Tozer,B.A., 9248
Trautman,A., 8984
Treder,H., 8979
Trubetskoĭ,A.I., 9238
Trumbore,F.A., 9184
Tsaĭ,B., 9268
Tsujimura,A., 9303
Tulczyjew,W., 9000
Twidle,G.G., 9112
Tzara,C., 9053
Tzou,K-H., 8987, 8995

Umanskij,J.S., 9423
Uretsky,J.L., 9329
Ursell,F., 9041

Vaĭnshteĭn,É.E., 9228
Valentin,S., 9399
Vanagas,V.V., 9058
van Bueren,H.G., 9165-6
van den Berg,G.J., 9198
van der Houven van Oordt, A.J., 9103
van der Leun,C., 9385
van der Vegt,A., 9419
Van der Velde,B., 9351
van Nooijen,B., 9370
Vartanyan,A.T., 9200
Vasil'ev,V.D., 9171
Vasil'ev,Yu.N., 9228
Vasserman,I.I., 9219
Vatsia,M.L., 9478
Vautier,R., 9261-2
Veits,I.V., 9304
Velasco,R., 9066
Verde,M., 9008
Vereshchagin,L.F., 9466
Veret,C., 9115
Verhaeghe,J., 9351
Vernier,P., 9485-6
Villars,F., 9327
Villena,L., 9023
Vitale,B., 8991
Vlasov,K.P., 9136
Vogler,G., 9275
Volger,J., 9156
Volke,C., 9443
Volokobinskiĭ,Yu.M., 9195, 9224
v.Szalay,L., 9130
Vul,B.M., 9196

Waddington,C.J., 9254
Wait,J.R., 9117
Wait,S.C., Jr, 9147
Walen,R.J., 9355
Wallis,G., 9182
Wallmann,J.C., 9334
Walsh,A., 9427
Wanic,A., 9297
Wapstra,A.H., 9370
Ward,A.F.H., 9027
Ward,W.H., 9473
Waring,W., 9185
Watanabe,K., 9247
Watanabe,S., 9323
Waterhouse,R.V., 9051
Watt,D.E., 9350, 9361
Wax,N., 9474
Weisskopf,V.F., 9313, 932
Weizel,W., 9221
Westheimer,G., 9480
Wheeler,C., 9422
Wiggins,T.A., 9065
Wilhelmy,W., 9148
Wilkie,D.R., 9438
Williams,D.E., 9152
Williams,F.E., 9096
Willson,A.J., 9040
Wilson,D.C., 9024
Winde,B., 9209
Wolfe,R., 9175
Wolsky,S.P., 9185
Wong,D.Y., 9005
Wood,J.L., 9427

Yanoshi (Jánossy),L., 897
Yarwood,J., 9036
Yemm,H., 9435

Zappa,L., 9358
Zemansky,M.W., 9145
Zhevandrov,N.D., 9032
Zickendraht,W., 9321
Ziering,S., 9039
Zmerli,A., 9080
Zobnina,V.N., 9457
Zorzoli,G.B., 9354